LA-UR-01-6694

Title:

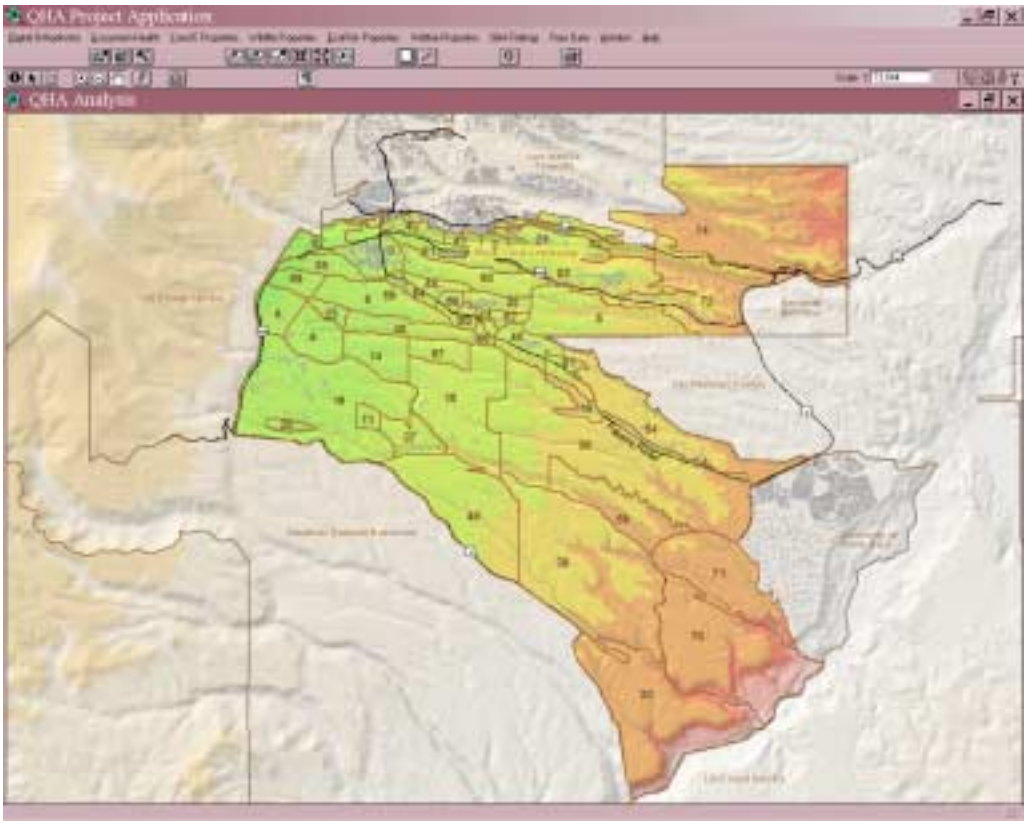
Quantitative Habitat Analysis ArcView Application Interface: Final Report FY01

Prepared by:

Laura K. Marsh, Timothy Haarmann, and Kathy Bennett

Date:

October 2001



Quantitative Habitat Analysis ArcView Application Interface: Final Report FY01

by

Laura K. Marsh, Timothy Haarmann, and Kathy Bennett

ABSTRACT

Quantitative Habitat Analysis (QHA) is a multi-faceted management, modeling, and planning system. A QHA that provides an objective, standardized, replicable, cost-effective, and accessible system for accurately determining the direction of stewardship is necessary, not only for continued management of wild areas by federal agencies, but for all professionals working in the field. QHA is currently comprised of five main models that will be analyzed within a geographic information system: 1) Ecological Land Classification, 2) Rapid Ecological Assessment (for general assessment) and U.S. National Vegetation Classification System/Element Occurrence (for ecosystem "health"), 3) BEHAVE wildfire and fuels monitoring, 4) Habitat Analysis and Modeling System (for wildlife), and 5) ECORSK.5 (for biocontaminants). Pilot study sites were placed on Bandelier and Los Alamos National Laboratory properties in ponderosa and piñon-juniper habitats in Fiscal Year 2000. In both habitat types, a control (treated or "desired future state") and an experimental (non-treated or disturbed state) were selected. The following methods were field tested: Rapid Ecological Assessment/The Nature Conservancy (vegetation and fauna); Gentry Method (vegetation); Dallmeier Method (vegetation); Modified Whittacker (vegetation); and Vegetation and Fuels Method (fuels and vegetation). Summaries of data collected and methodologies were compared, and a "common currency" for analysis results was developed. In FY01, a QHA tool was developed in ArcView to test the pilot data as a model for a user-friendly application in natural resources management.

INTRODUCTION

This is the final report for Fiscal Year 2001 on the second year of the Biological Resources Management Plan Special Project Quantitative Habitat Analysis (QHA). This report serves as a supplement to the computer-based tool created in ArcView by Kathy Bennett. Details of the QHA project up to now can be reviewed in the following manuscripts: Marsh, Laura K., Haarmann, Timothy K. (2000). Quantitative Habitat Analysis: A progress report on Phase I of the Work Plan; 16 pgs. LA-UR-00-6018; Marsh, Laura K., Haarmann, Timothy K. (2000). Quantitative Habitat Analysis: A progress report on Phase II of the Work Plan; 83 pgs. LA-UR-00-6017; and Marsh, Laura K., Haarmann, Timothy K. (2000). Quantitative Habitat Analysis: Final Report for FY00; 289 pgs. LA-UR-00-6016.

Modeling has become an important tool for ecologists and for the study of ecological systems. Many models exist to answer a multitude of questions with regard to management and status of habitats (c.f., QHA reports I & II). Part of what ecologists do is revise hypotheses and collect new data, the model and the view of nature that it represents often undergo many changes from the initial conception to what is deemed the final product (Jackson et al. 2000). This is especially true for the QHA project since it is a work in progress beginning with a pilot study. Quantitative models translate ecological hypotheses into predictions that can be evaluated in light of existing or new data (Jackson et al. 2000). That said, it is important to remember models in and of themselves are only tools and are not reality. Thus, there is no correct or absolute model. QHA, then, can be considered a tool that is able to adapt and change to the needs of the Ecology Group and perhaps the institution as a whole.

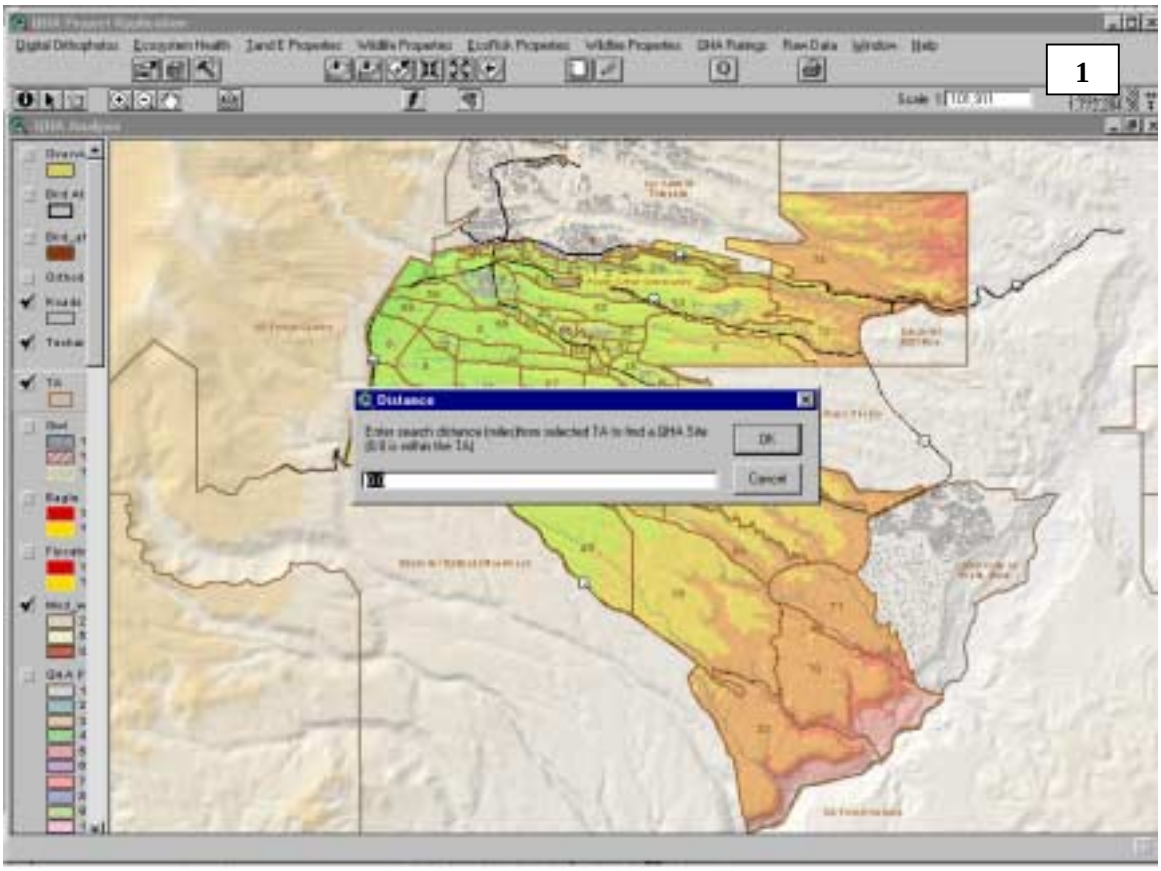
The pilot study was conducted primarily to compare field data collection methods, ultimately select a standard field method, gain preliminary comparisons between the sites, and begin analysis, in part, with the "common currency" concept. The common currency selected for the pilot study defines different habitat features on a gradient from "high" to "low" quality in terms of grades or ranks based on a common, corresponding scale. These scores will be derived independently based on the analysis and method used for data collection and will be comparable across data sets. The raw data sets as well as common currency scores from the pilot study were used for the launch of the first QHA ArcView tool.

USING QHA

The QHA tool was designed to be a user-friendly yet robust system for answering questions regarding resource management with respect to institutional goals. We intentionally created a tool that allows us the flexibility of adding components, such as statistical packages for data analysis, as needed. Initially, however, we wanted to demonstrate the basic concepts behind the use of the QHA model.

The following section will guide the reader through a series of desktop figures from the QHA tool. This is designed to be an example, and not necessarily the complete QHA tool.

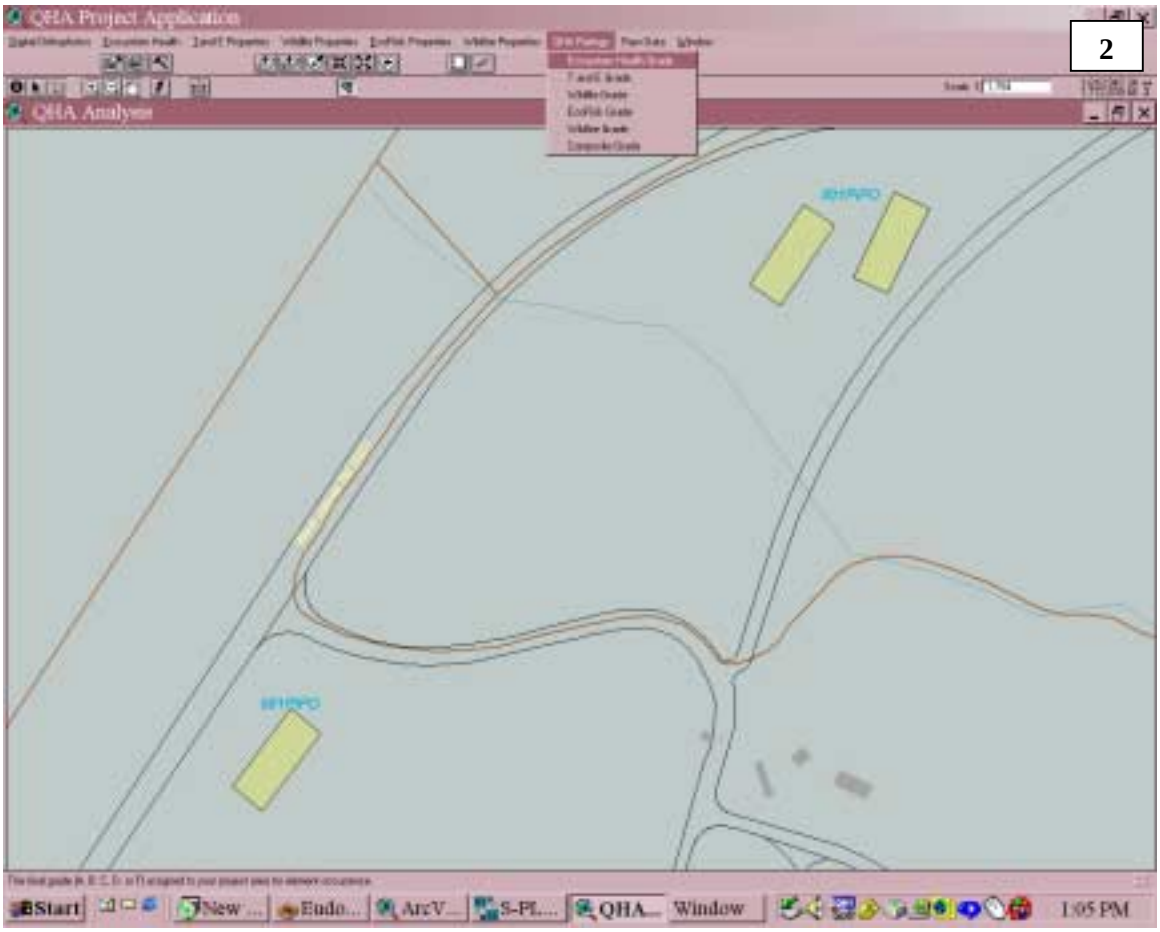
Figure 1. On the first screen, a picture of Los Alamos National Laboratory (LANL) and all of the technical areas (TAs) appears. A tool (indicated at the top) can be used to select a TA to look for QHA sites or other data available in the area.



Notice the menu items: Digital Orthophotos, Ecosystem Health, T and E Properties, Wildlife Properties, EcoRisk Properties, Wildfire Properties, QHA Ratings, Raw Data, Window, and Help. Most of the buttons are typical of the ArcView program, except for the LANL button (shown) and the “Q” button, which brings up the QHA application.

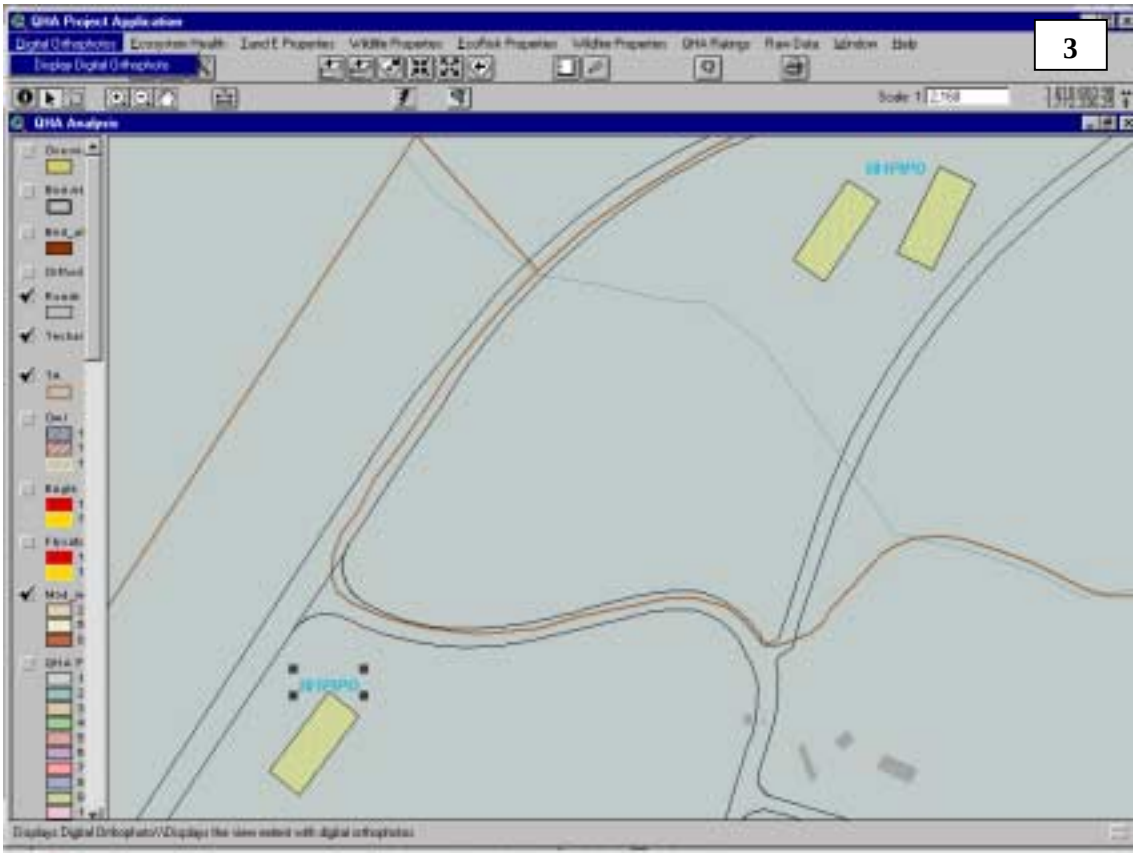
If a distance is entered within the TA, then the area indicated will include the TA plus an area outside of the TA. If “0.0” is selected, then the information will be found within the desired TA.

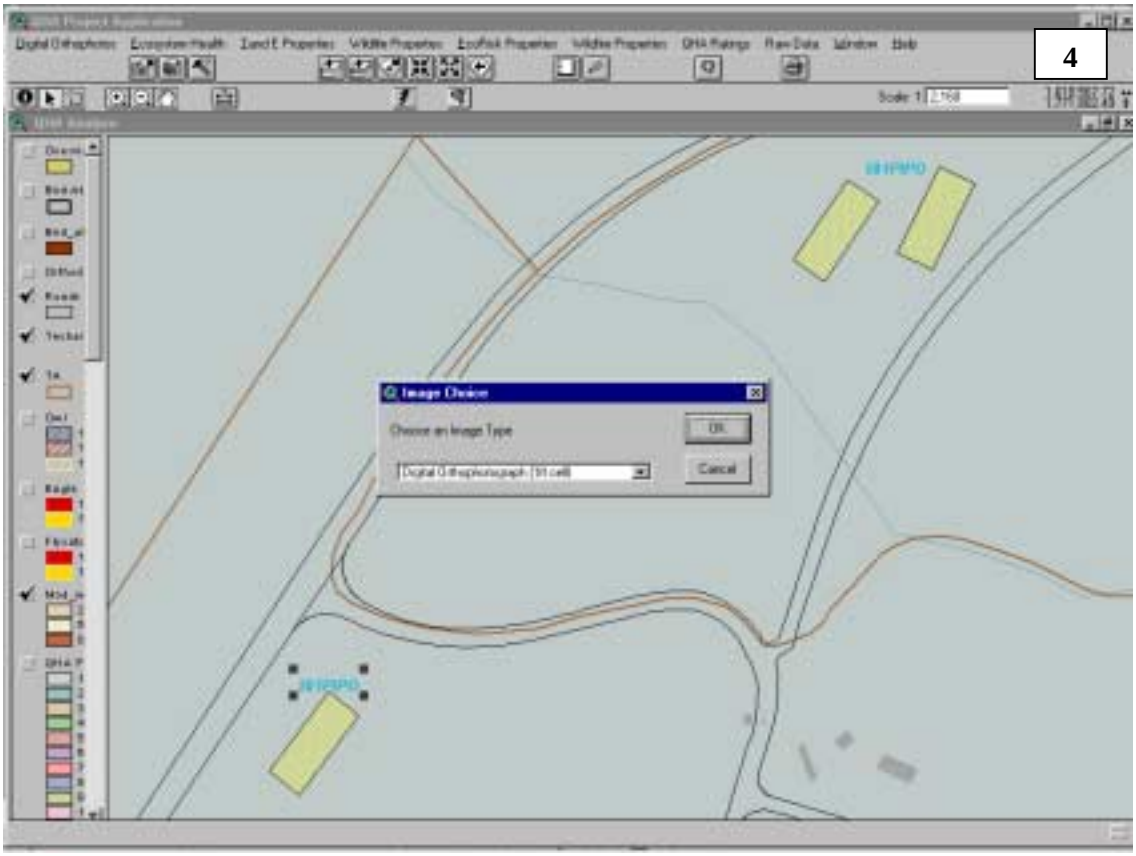
Figure 2. The QHA information is drawn for the selected TA, here is TA-69 near the curve in Highway 501. Three plots are shown here.

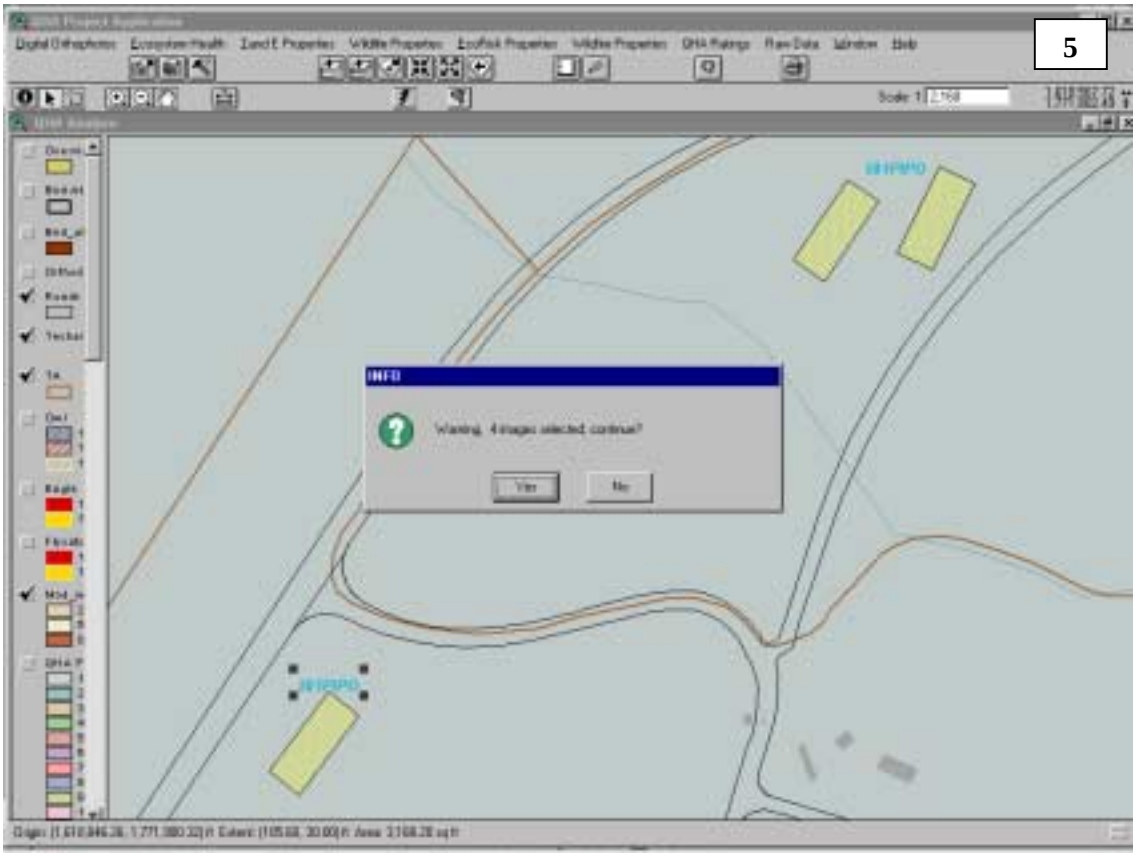


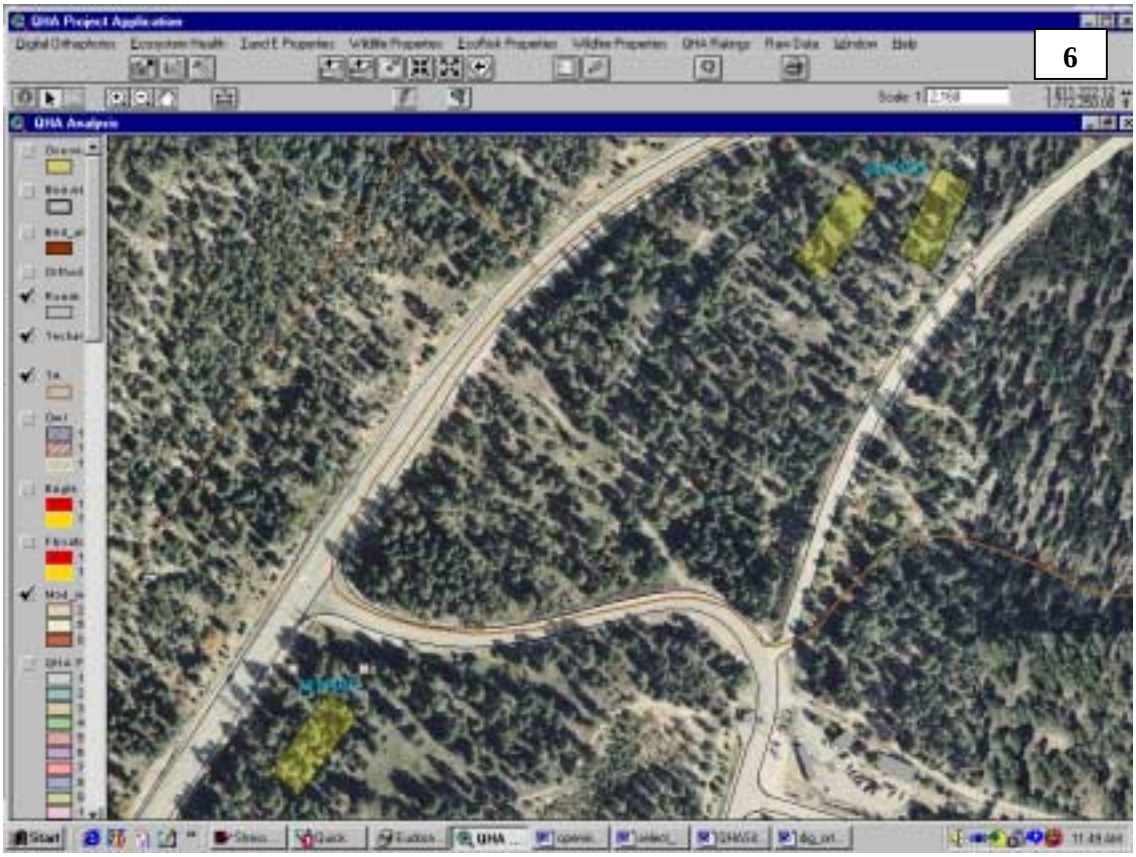
Through this menu you can assess directly the grade for each QHA property instead of going through each individual property menu.

Figures 3–6. If Digital Orthophoto is selected from the menu (3; upper left), then a message box appears making sure of the figure type you would like to select (4). Then a warning pops up to be sure the figure should continue (5). Depending on time constraints and the powers of the computer being used, orthophotos may take time to upload and draw. Once the orthophoto has been selected and drawn, we see the type of habitat in the region, with the QHA plots overlaid on the site (6; plots are in yellow).




4
Image Choice
Choose an Image Type
OK
Cancel


5
INFO
Warning, 4 images selected continue?
Yes
No


6

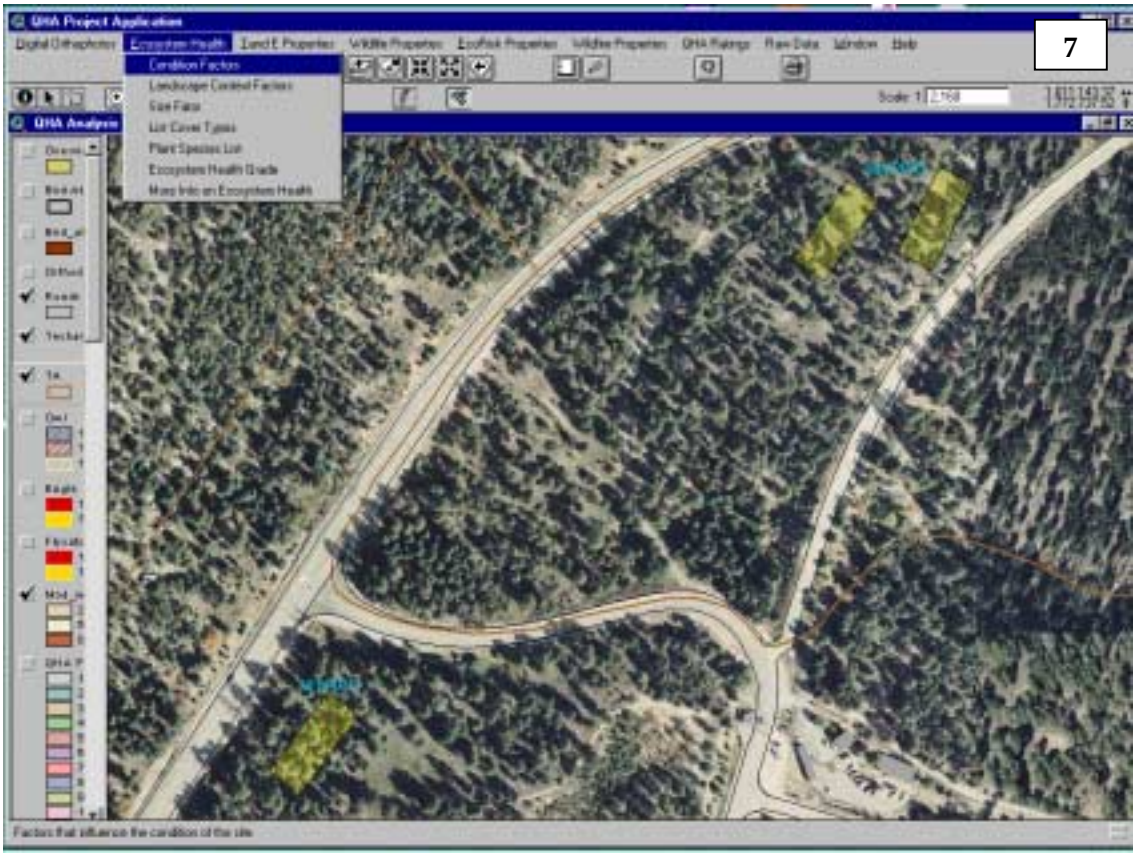
Figures 7–25. The next selection that can be made is Ecosystem Health (7). This section is based on The Nature Conservancy's "Element Occurrence" (EO) qualitative assessment. Details of this can be found in the QHA Final Report for 2000. If Condition Factors is selected, then an information box pops up giving the EO scores for those conditions (8). The same is true for Landscape Context Factors (9 and 10) and Size Factors (11 and 12). In each case, a box comes up with details about each of those selections.

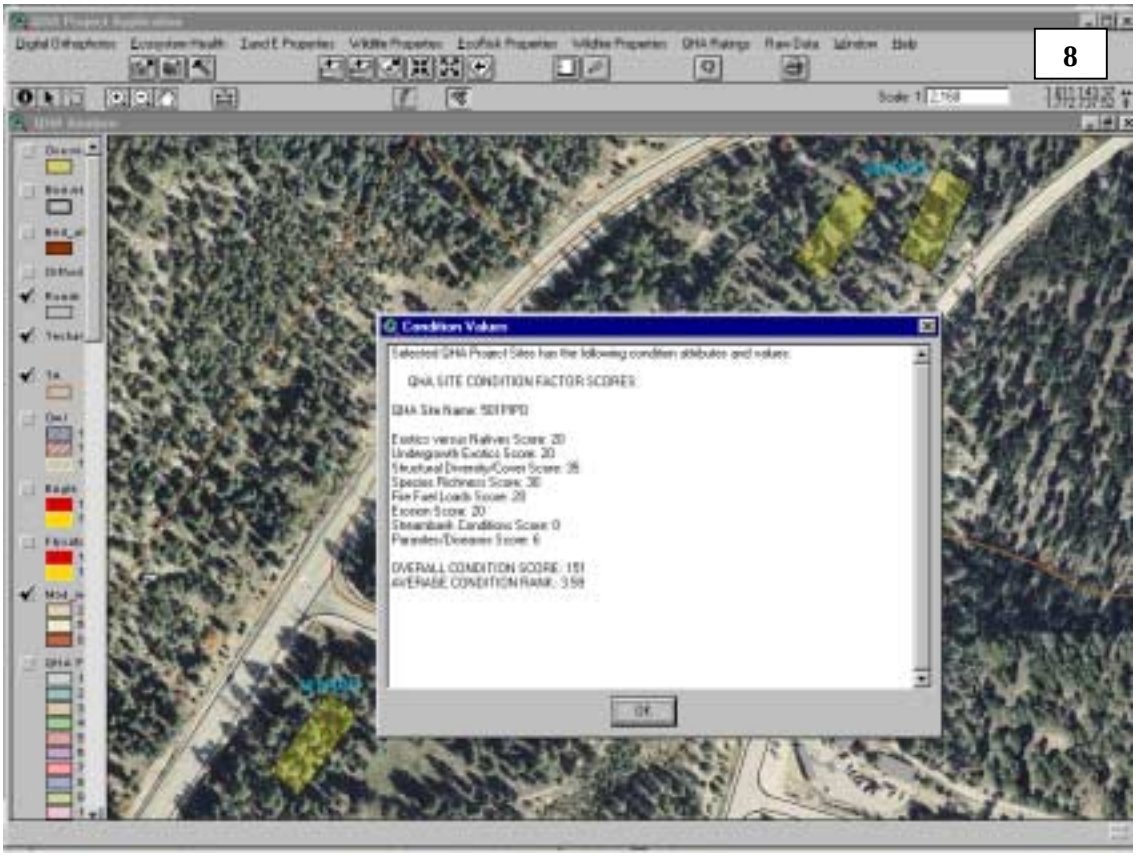
If List Cover Types is selected (13), a box asking for the QHA project area needs to be selected (14 and 15; we are looking at 501PIPO), and then the cover type for that area comes up (16).

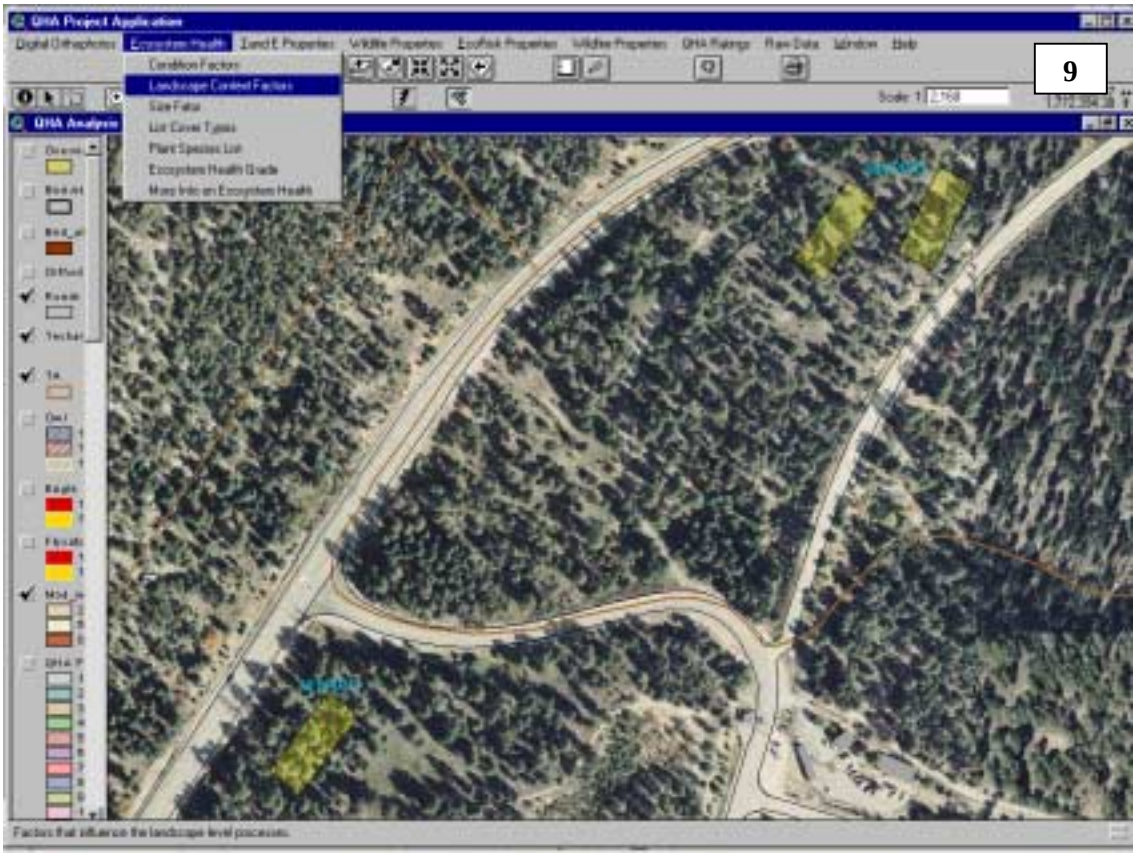
If Pant Species List is selected (17), then the species and common names are listed from the data gathered in that site (18).

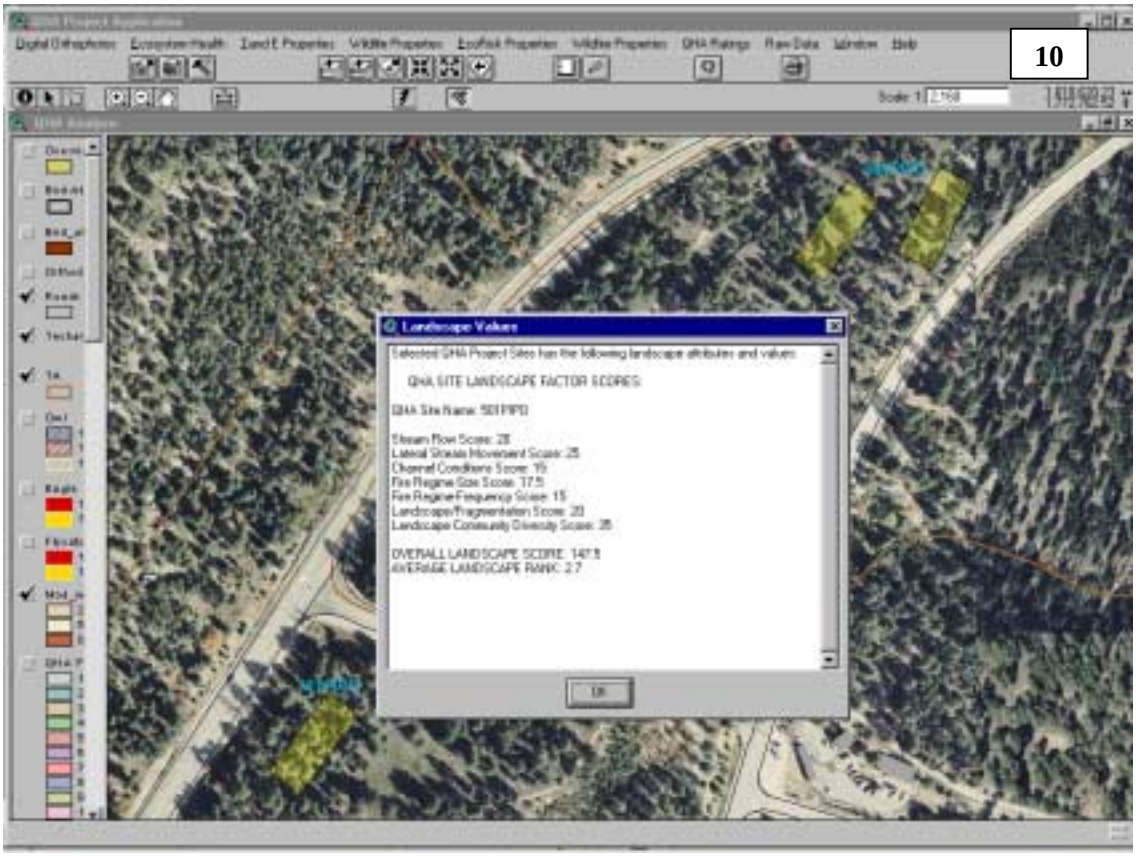
If Ecosystem Health Grade is selected (19), then the overall grade as well as the cumulative grades for each section (e.g., Condition) are displayed (20). If it is easier to see a visual of the data presented, then a chart can be displayed as well (21 and 22).

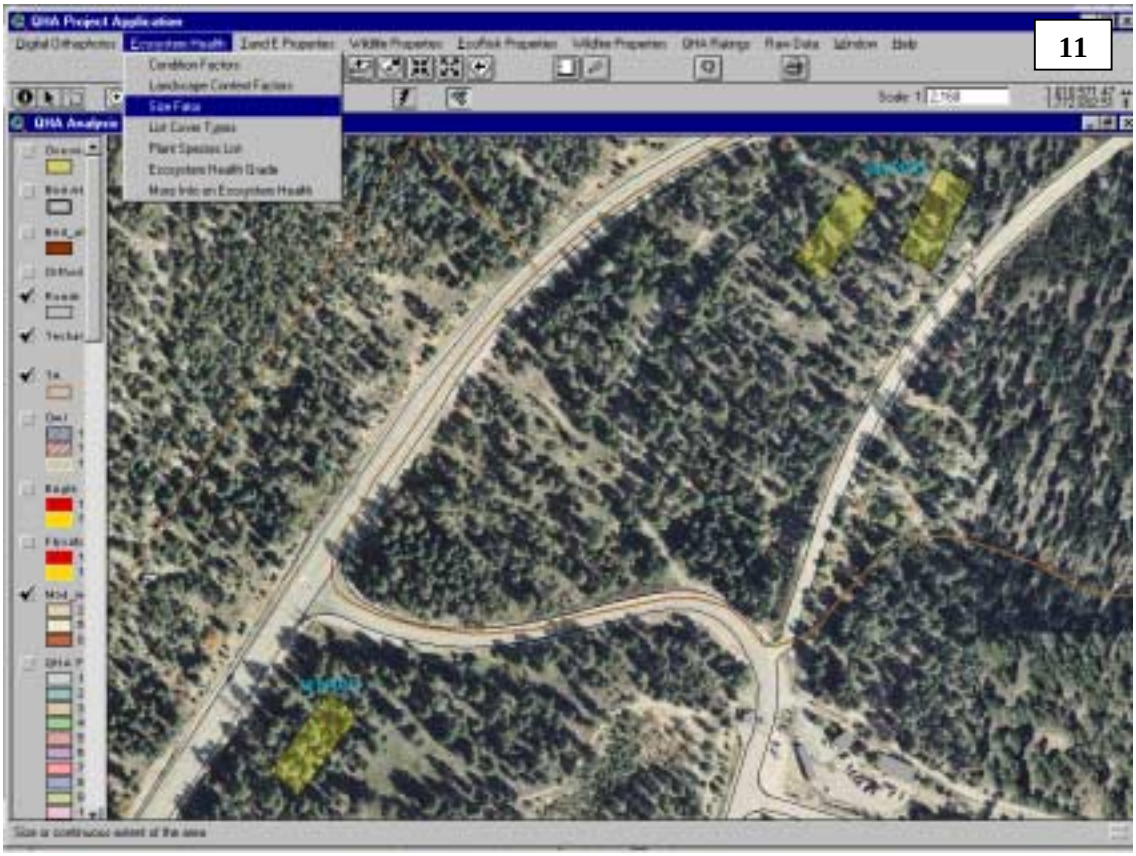
Finally, if More Info on Ecosystem Health is selected (23), then a Word document with details of ecosystem health can be read (24). This information comes from the QHA Final Report for FY00. Close Word when viewing is complete (25) and you will be back in ArcView.

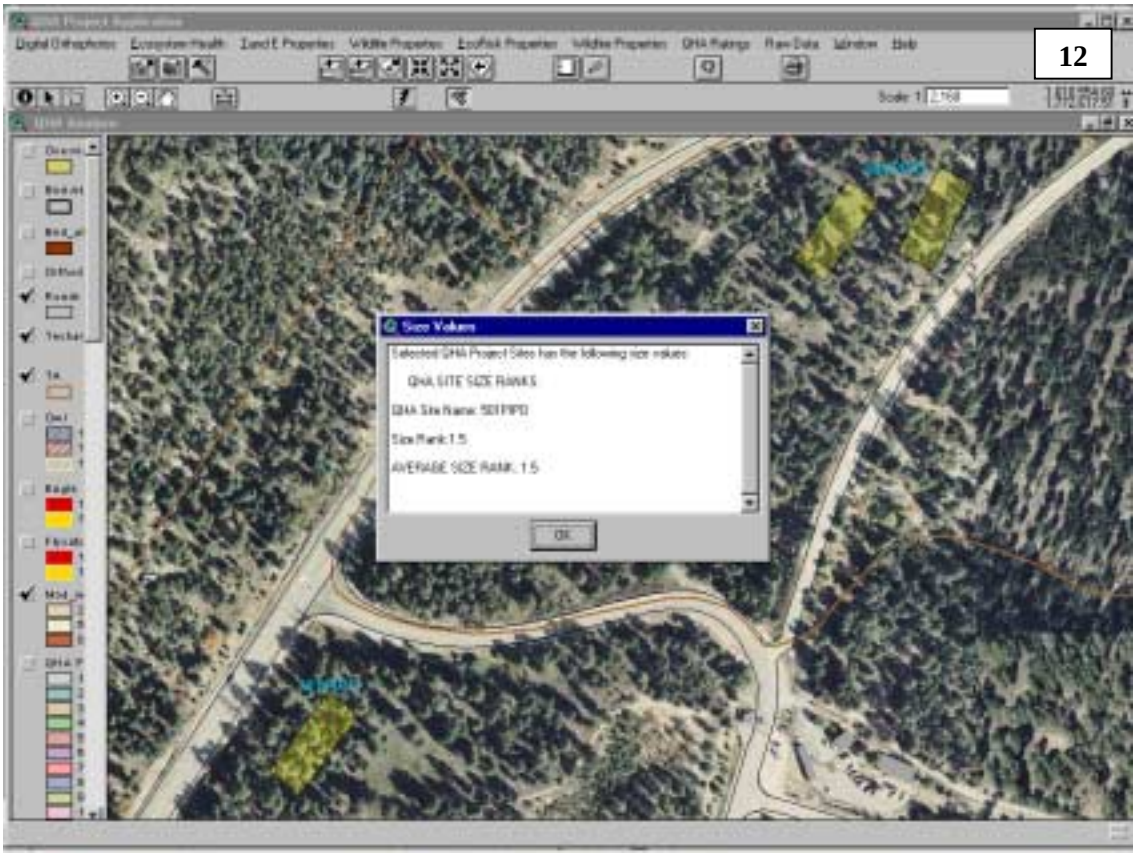

7
QHA Project Application
Digital Orthophotos
Ecosystem Health
Land E Properties
Wildlife Properties
EcoRisk Properties
Wildfire Properties
QHA Ratings
Raw Data
Window
Help
Condition Factors
Landscape Context Factors
Size Fatos
List Cover Types
Plant Species List
Ecosystem Health Grade
More Info on Ecosystem Health
QHA Analysis
Factors that influence the condition of the site

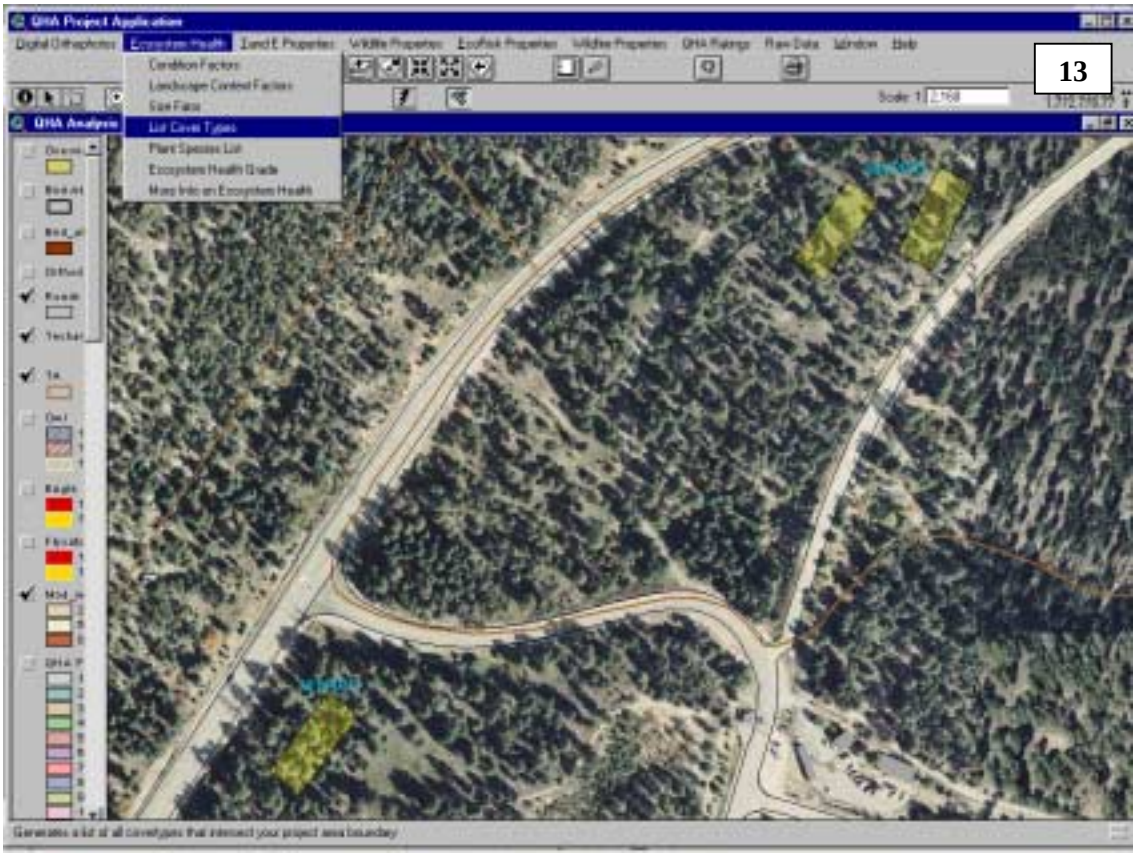

8
Condition Values
Selected QHA Project Sites has the following condition attributes and values:
QHA SITE CONDITION FACTOR SCORES
QHA Site Name: SDFPD
Exotics versus Natives Score: 20
Undergrowth Exotics Score: 20
Structural Diversity/Cover Score: 35
Species Richness Score: 35
Fire Fuel Loads Score: 20
Erosion Score: 20
Streambank Conditions Score: 0
Parasites/Diseases Score: 6
OVERALL CONDITION SCORE: 151
AVERAGE CONDITION RANK: 3.59
OK

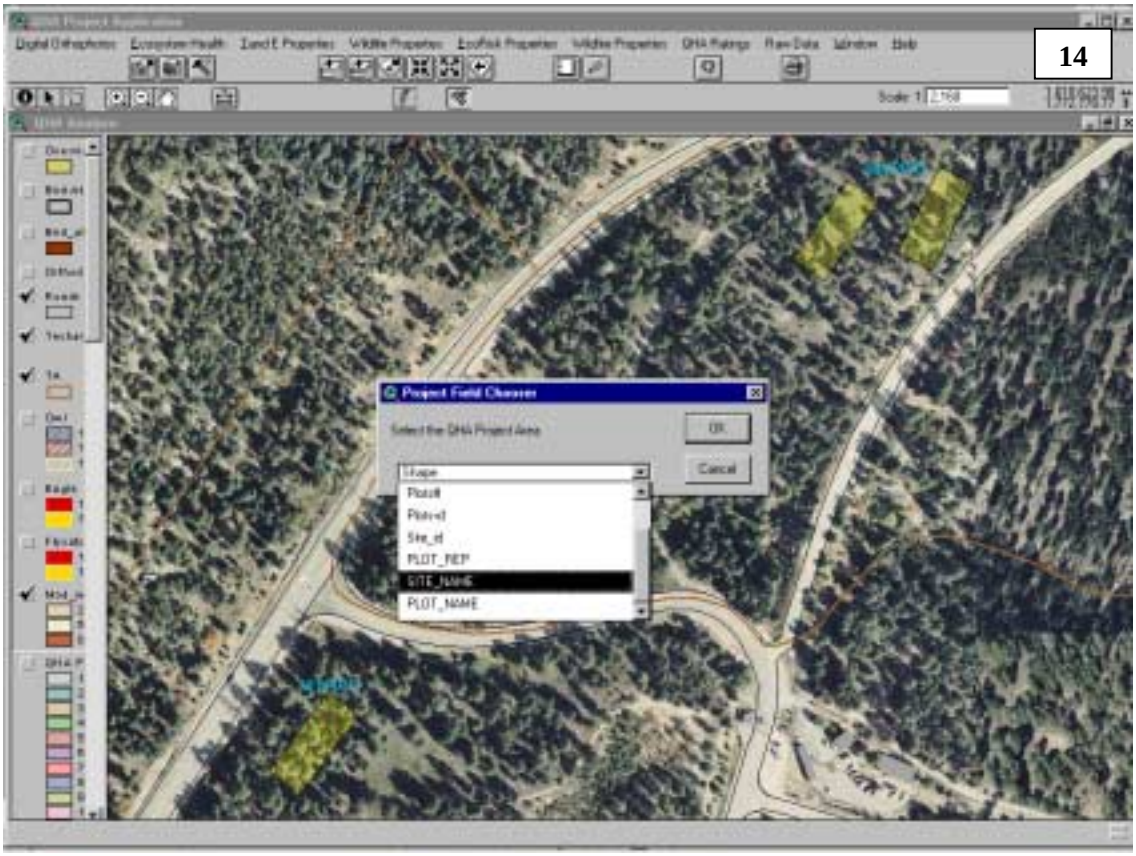

9
Landscape Context Factors

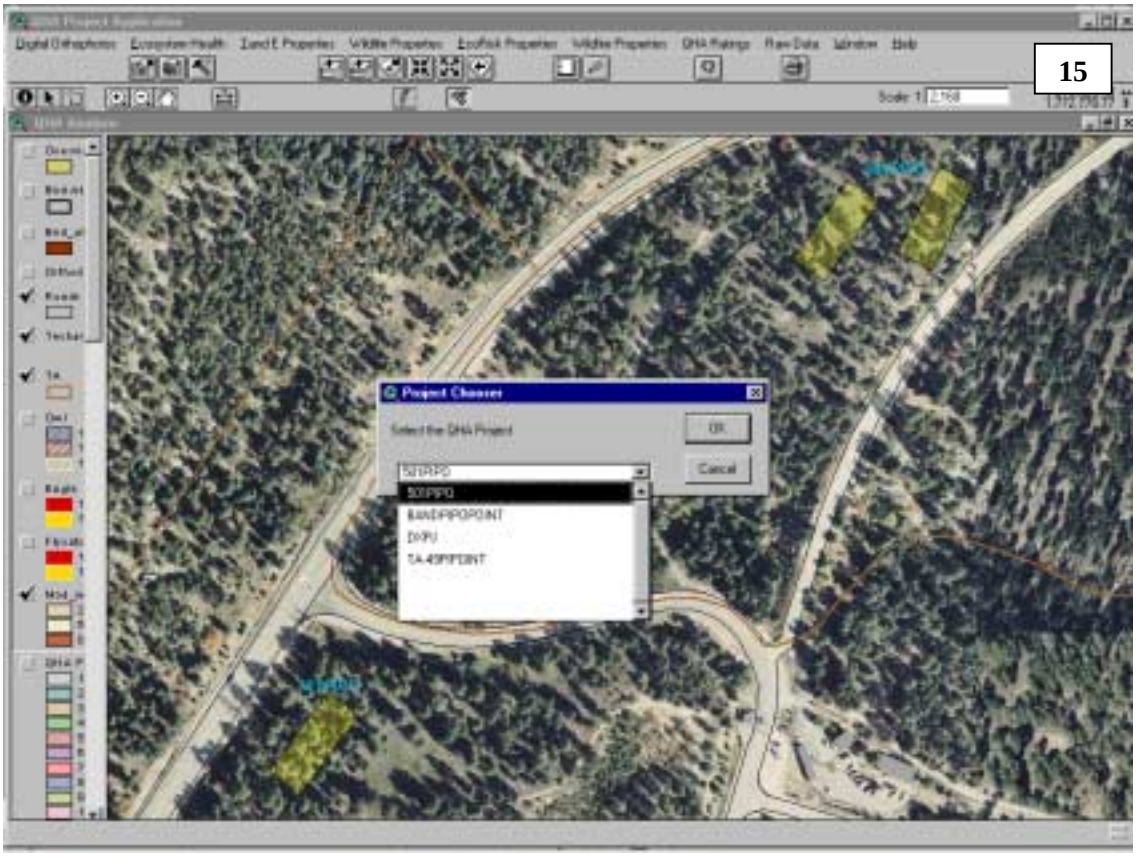

10
Landscape Values

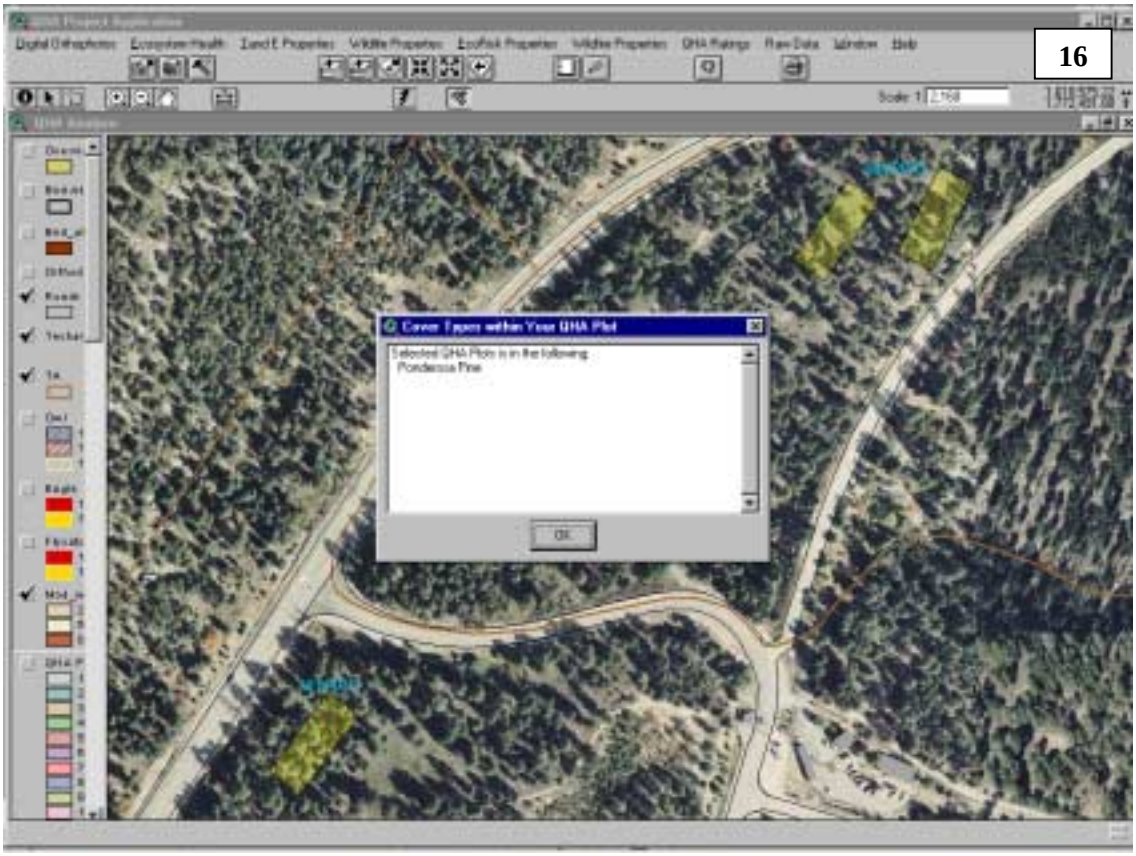

11
Condition Factors
Landscape Context Factors
Size Factor
List Cover Types
Plant Species List
Ecosystem Health Grade
Map Info on Ecosystem Health

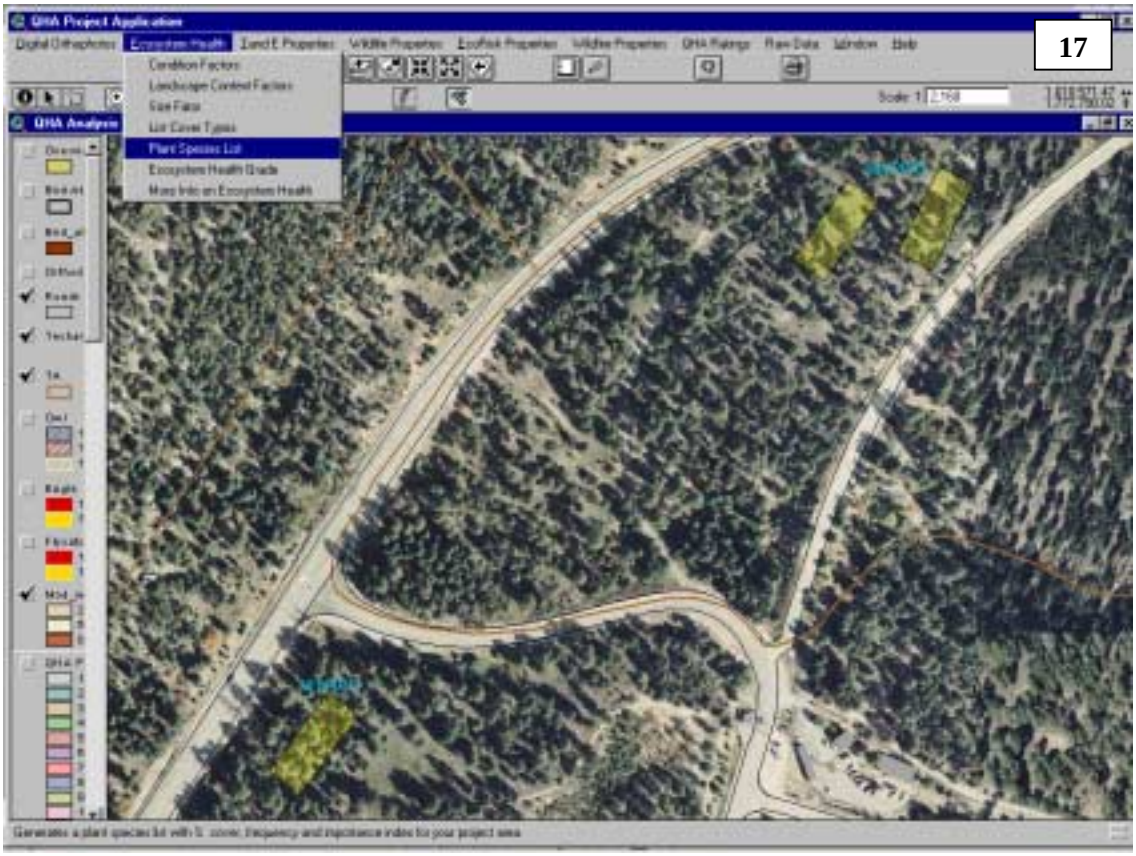

12
Size Values
OK

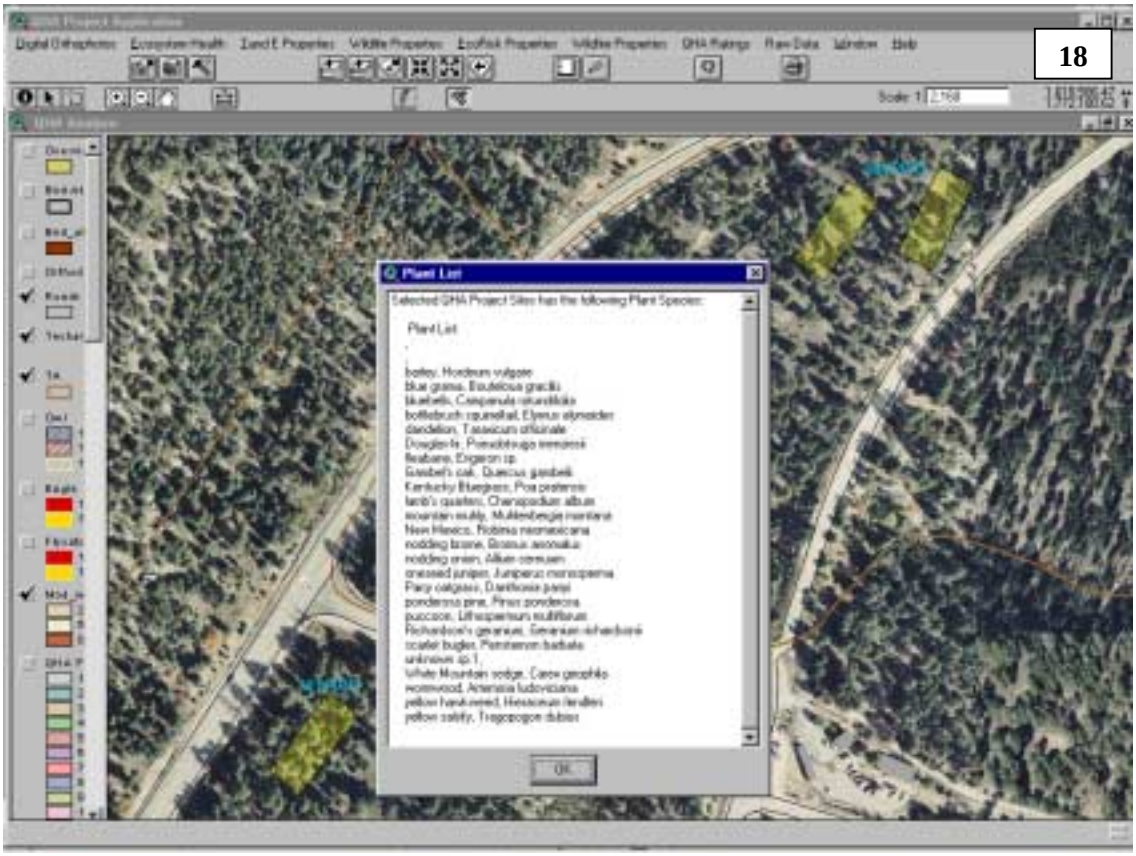

13

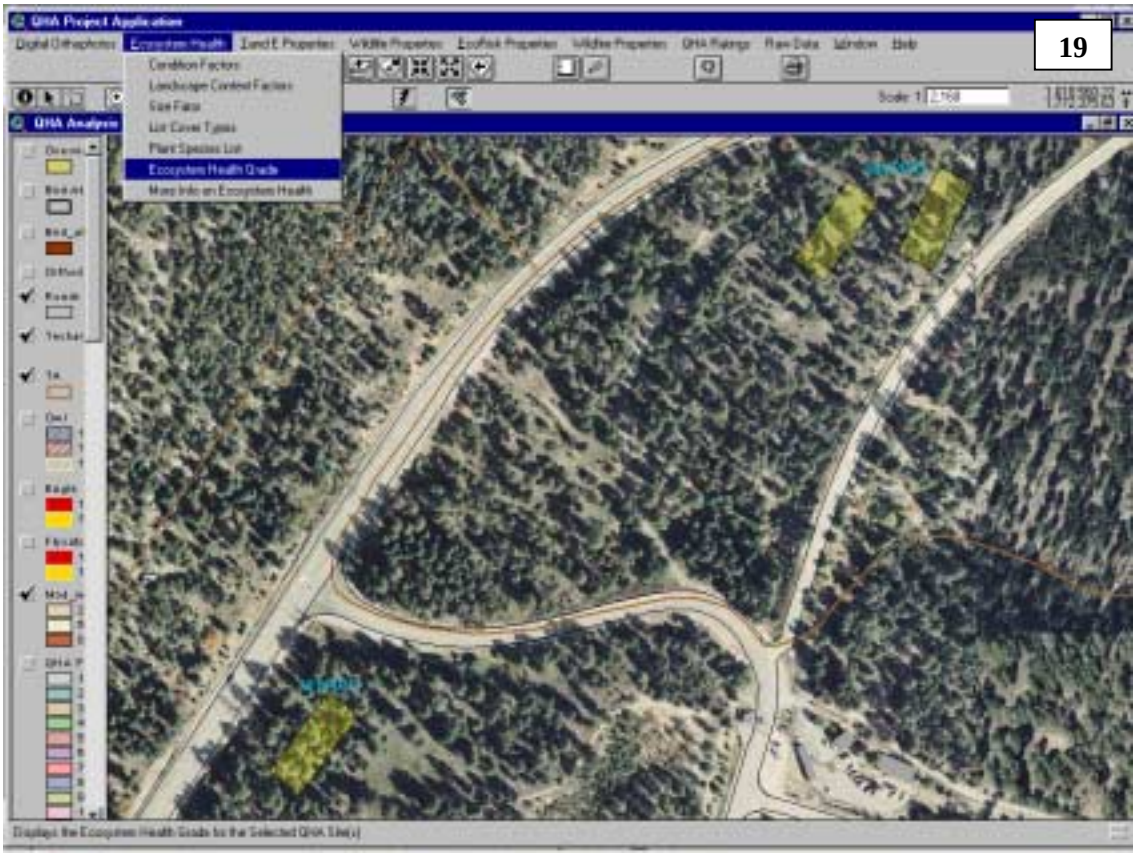

14
Project Field Chooser
OK
Cancel
PLOT_NAME

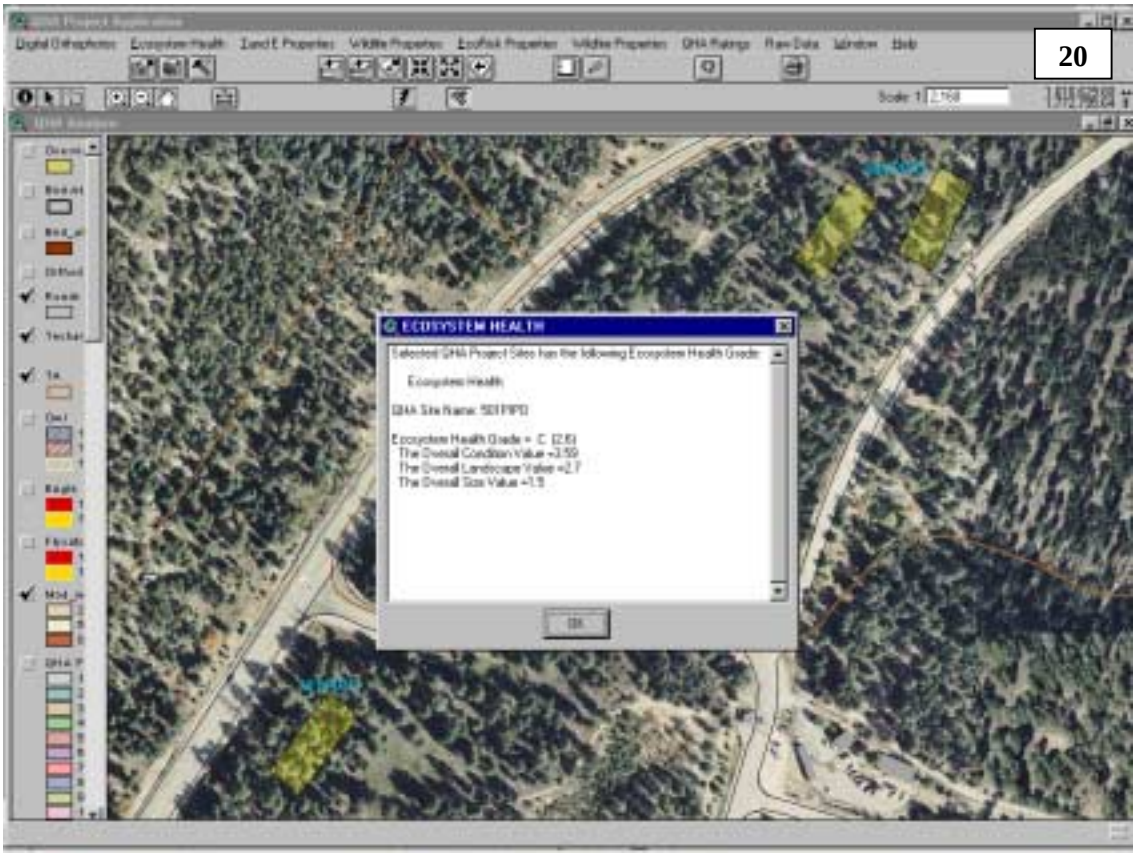

15
Project Chooser
Select the GHA Project
OK
Cancel

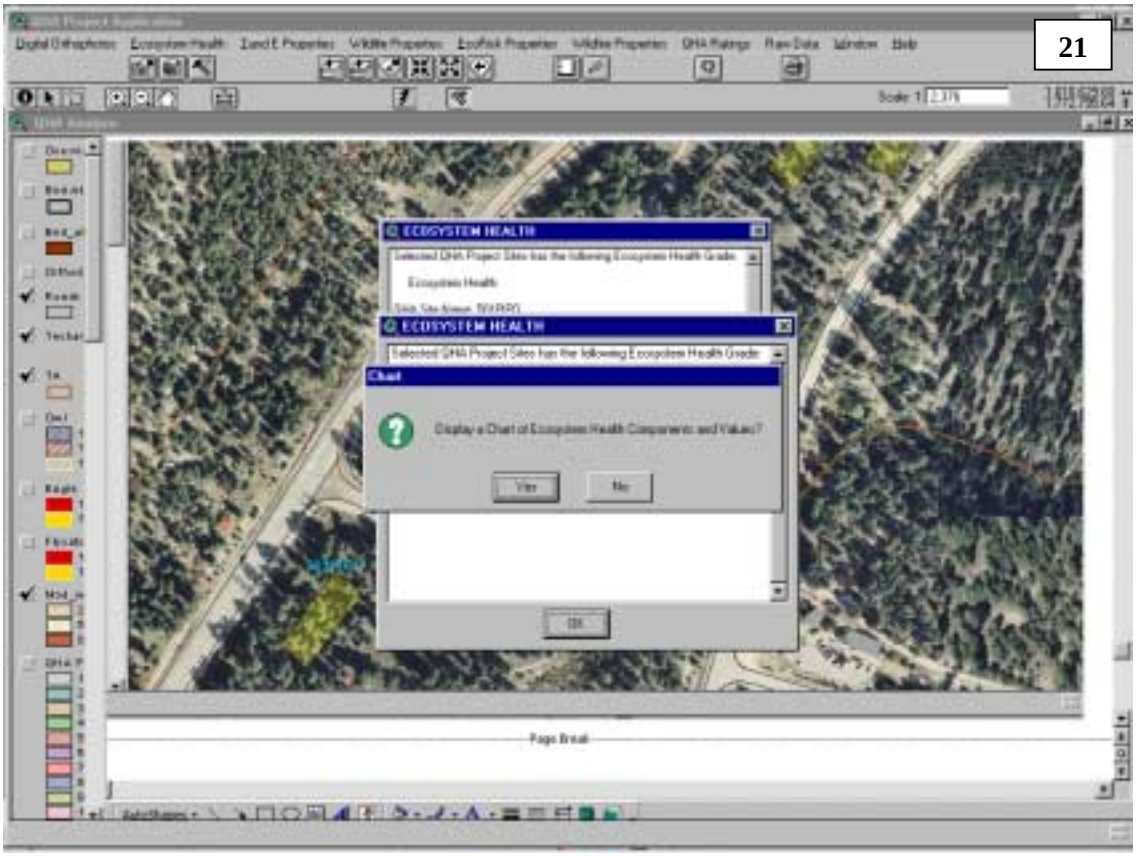

16
Cover Types within Your GHA Plot
Selected GHA Plots is in the following:
Ponderosa Pine
OK

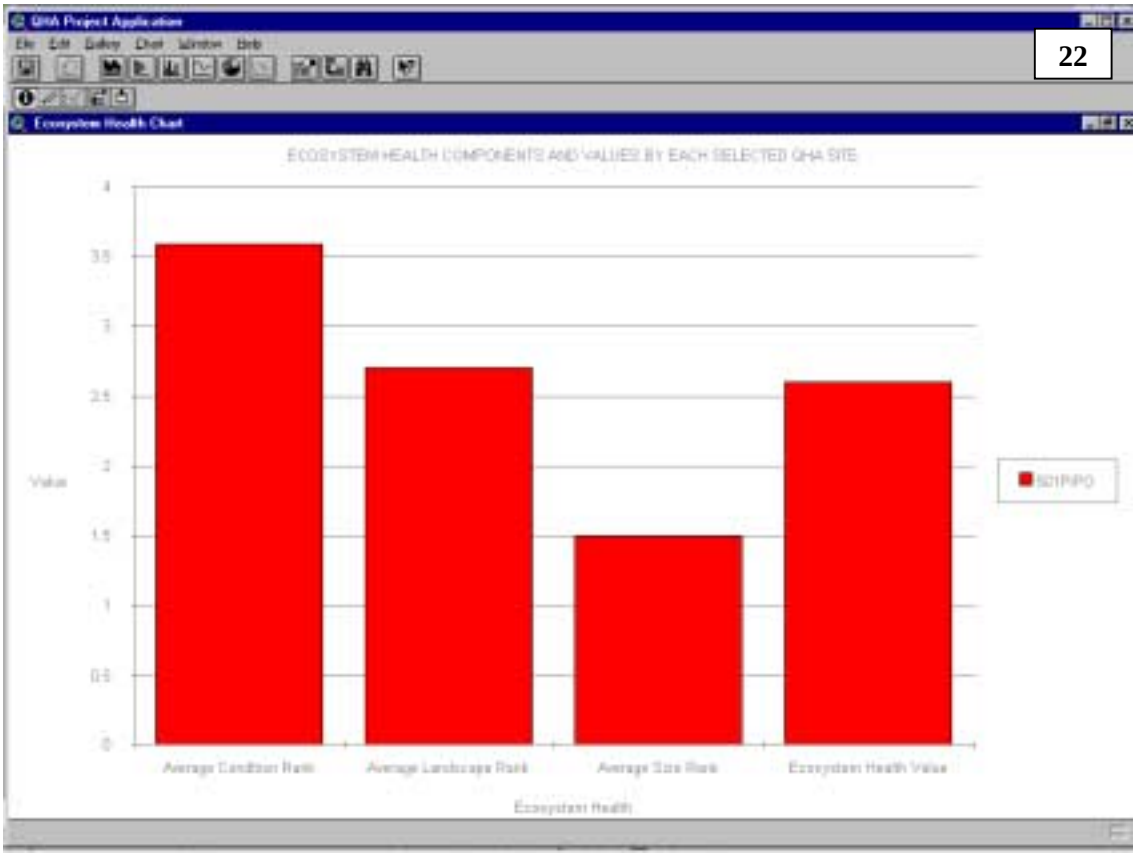

17
Condition Factors
Landscape Context Factors
Size Factor
List Cover Types
Plant Species List
Ecosystem Health Grade
Map Info on Ecosystem Health

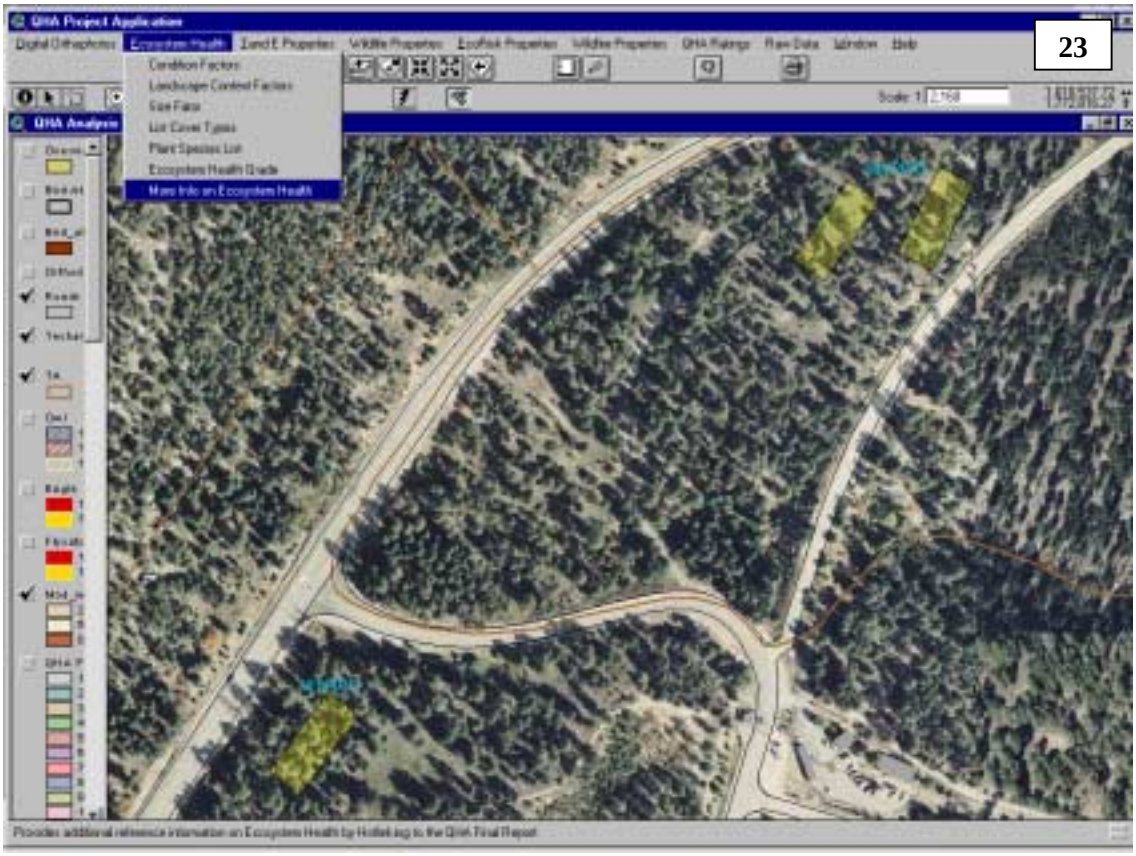

18
Plant List
Selected QHA Project Sites has the following Plant Species:
Plant List
OK

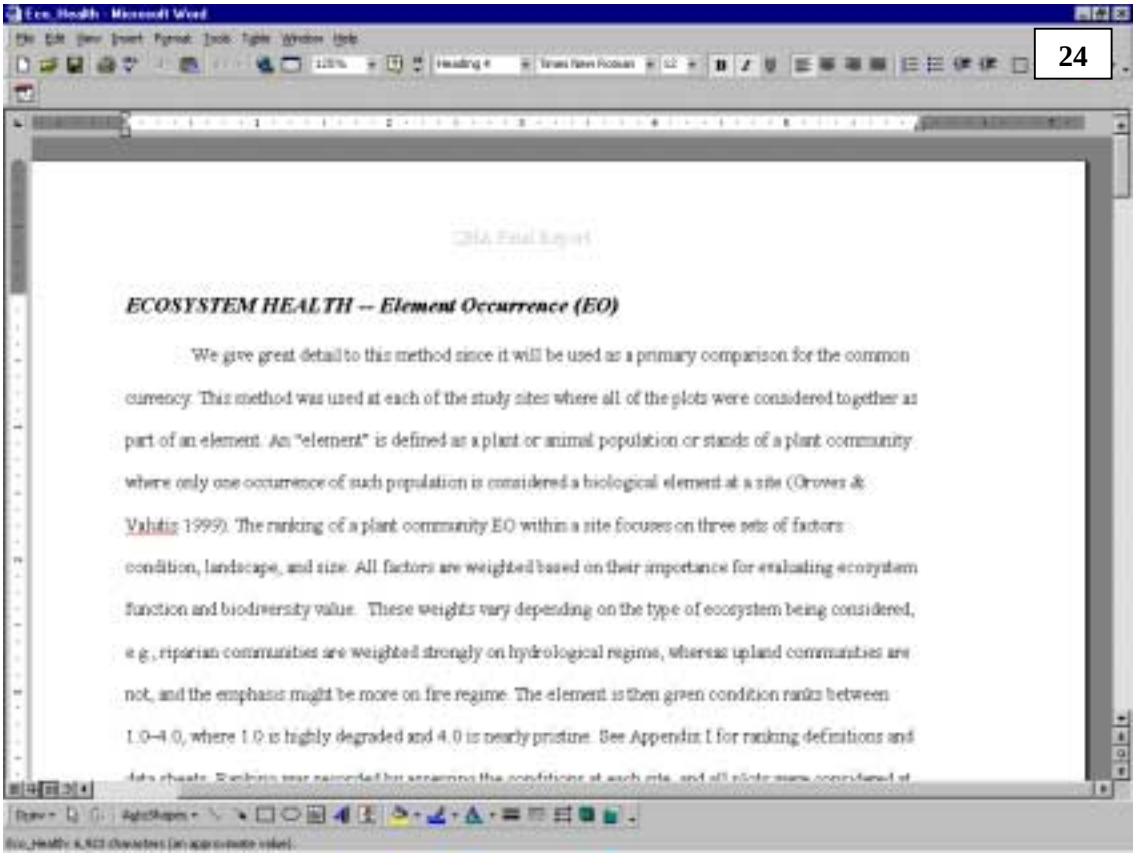

19
Condition Factors
Landscape Context Factors
Size Factor
List Cover Types
Plant Species List
Ecosystem Health Grade
Map Info on Ecosystem Health

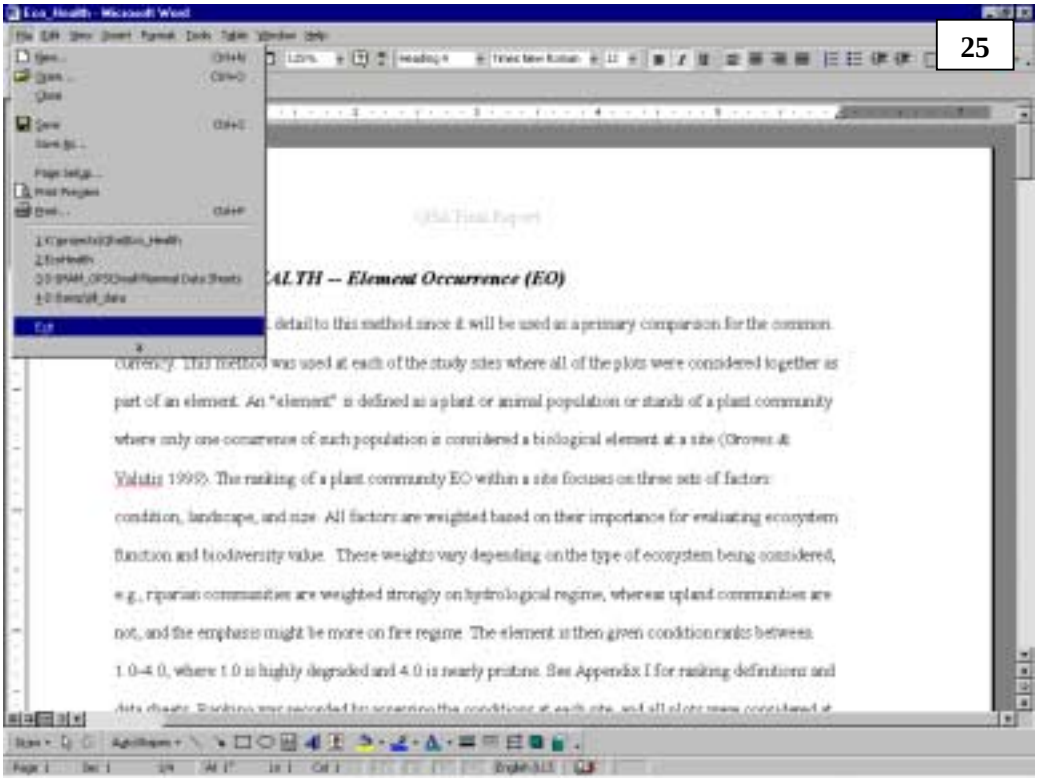

20
ECOSYSTEM HEALTH
Selected QHA Project Sites has the following Ecosystem Health Grade:
Ecosystem Health
Ecosystem Health Grade = C (2.6)
The Overall Condition Value =3.59
The Overall Landscape Value =2.7
The Overall Size Value =1.5
OK


21
ECOSYSTEM HEALTH
ECOSYSTEM HEALTH
Chart
Display a Chart of Ecosystem Health Components and Values?
Yes
No
OK

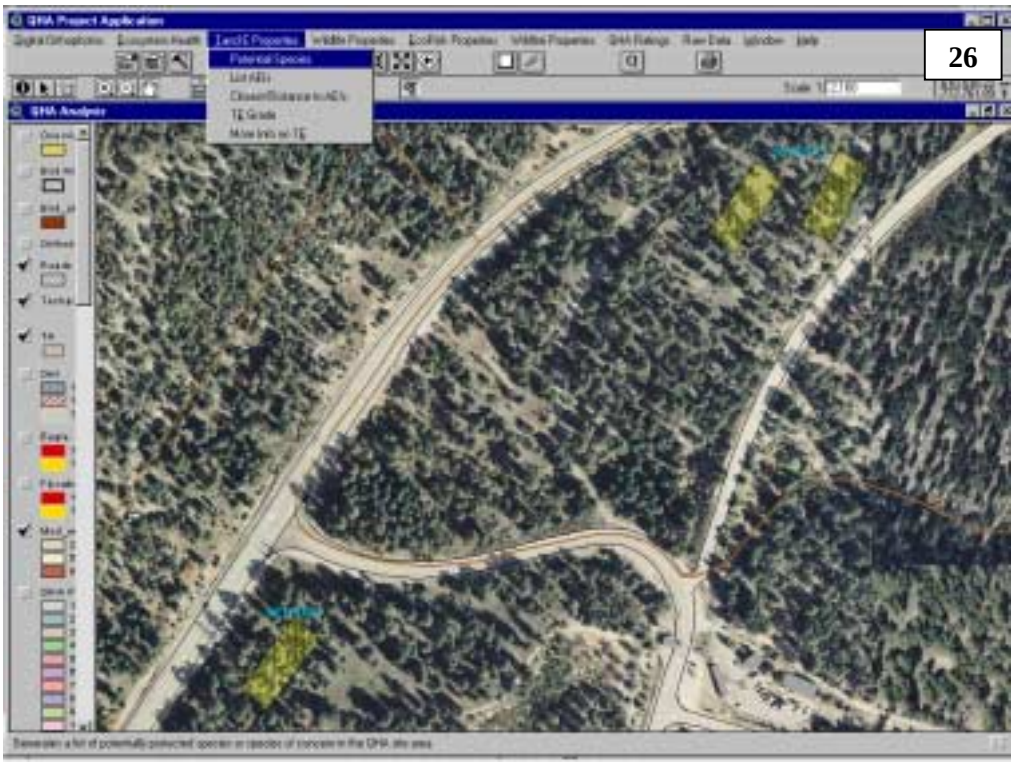

22
QHA Project Application
Ecosystem Health Chart
ECOSYSTEM HEALTH COMPONENTS AND VALUES BY EACH SELECTED QHA SITE
Value
Average Condition Rank
Average Landscape Rank
Average Size Rank
Ecosystem Health Value
Ecosystem Health


23

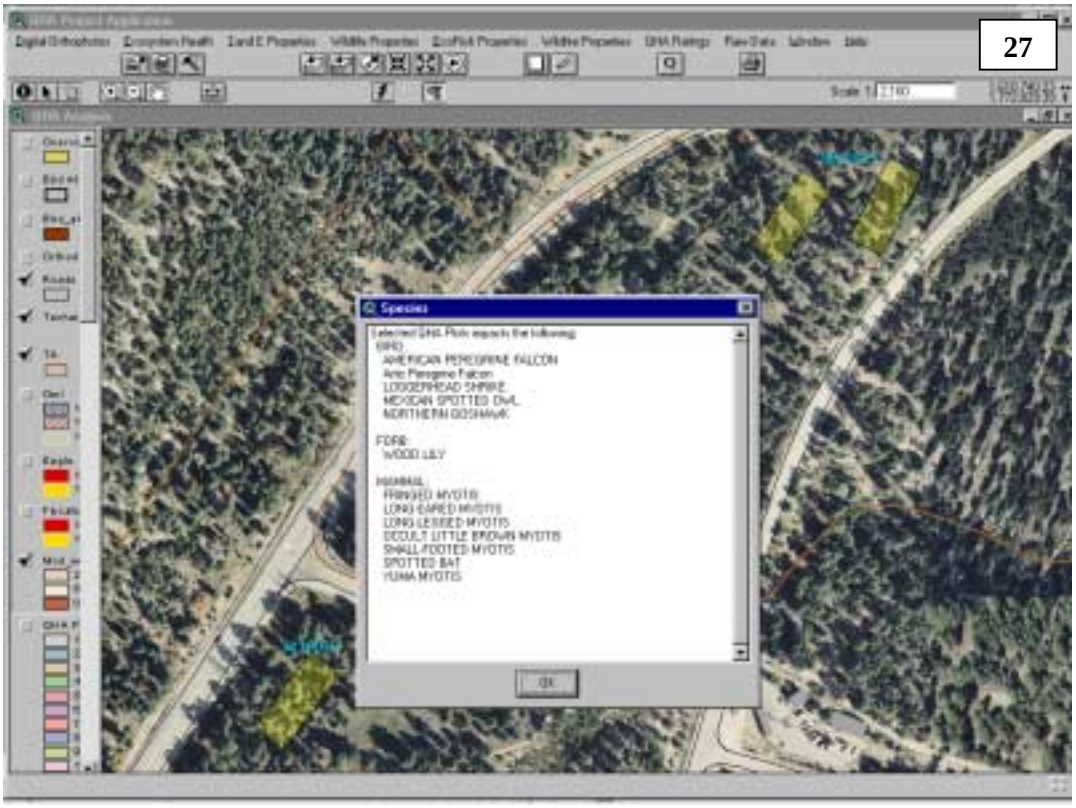

24
ECOSYSTEM HEALTH -- Element Occurrence (EO)
We give great detail to this method since it will be used as a primary comparison for the common currency. This method was used at each of the study sites where all of the plots were considered together as part of an element. An "element" is defined as a plant or animal population or stands of a plant community where only one occurrence of such population is considered a biological element at a site (Groves & Valutis 1999). The ranking of a plant community EO within a site focuses on three sets of factors: condition, landscape, and size. All factors are weighted based on their importance for evaluating ecosystem function and biodiversity value. These weights vary depending on the type of ecosystem being considered, e.g., riparian communities are weighted strongly on hydrological regime, whereas upland communities are not, and the emphasis might be more on fire regime. The element is then given condition ranks between 1.0–4.0, where 1.0 is highly degraded and 4.0 is nearly pristine. See Appendix I for ranking definitions and



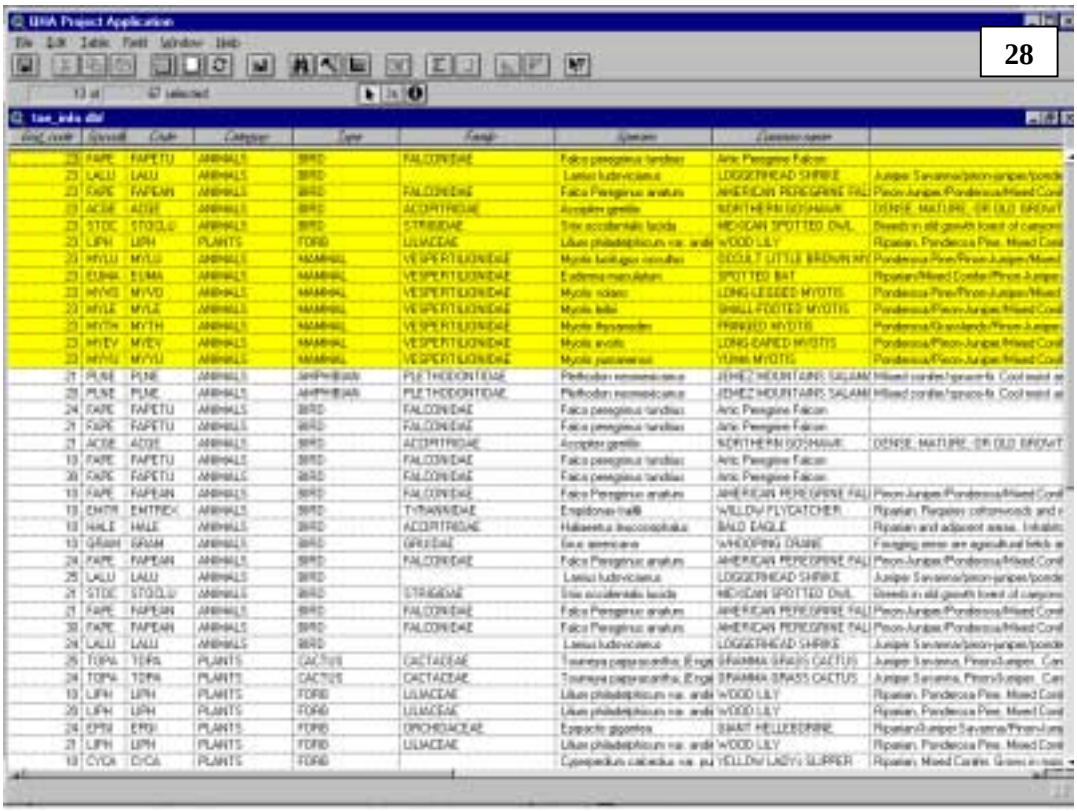
Figures 26–41. T and E Properties stands for Threatened and Endangered Species Properties. The data available in this section are primarily in the form of Areas of Environmental Interest (AEIs).



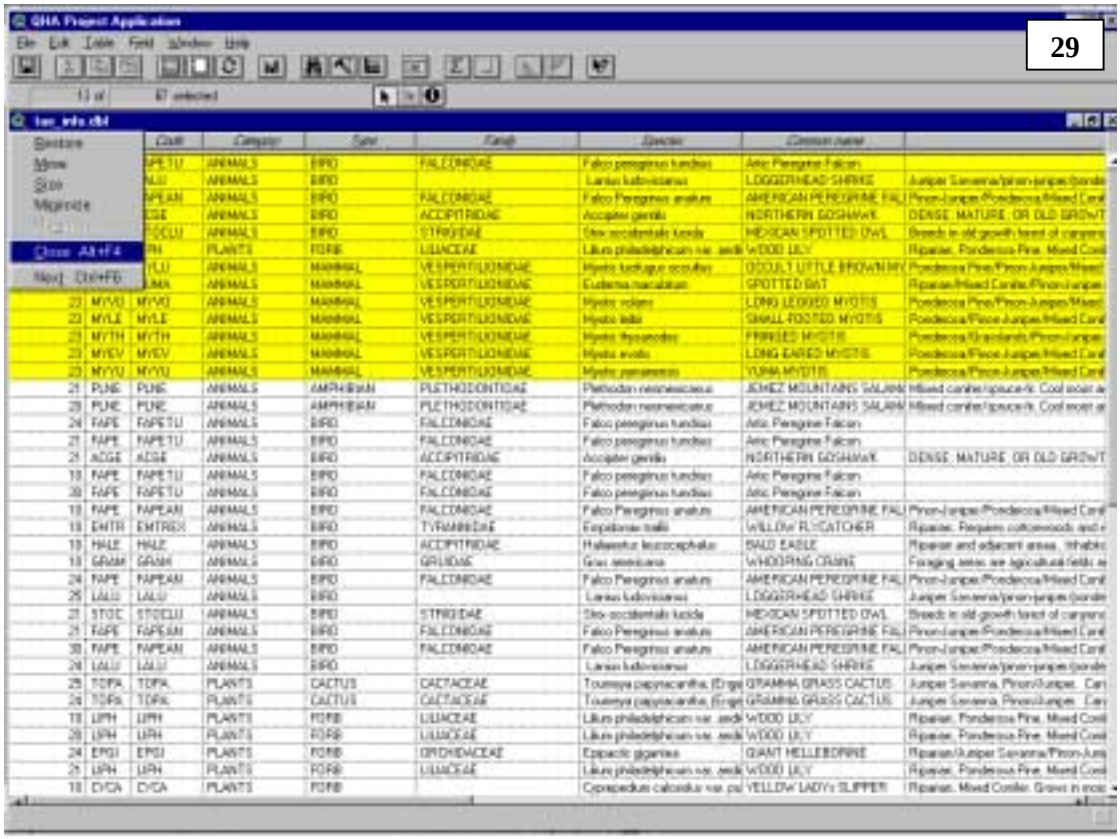
'Potential Species' lists species that could potentially occur within the project site.



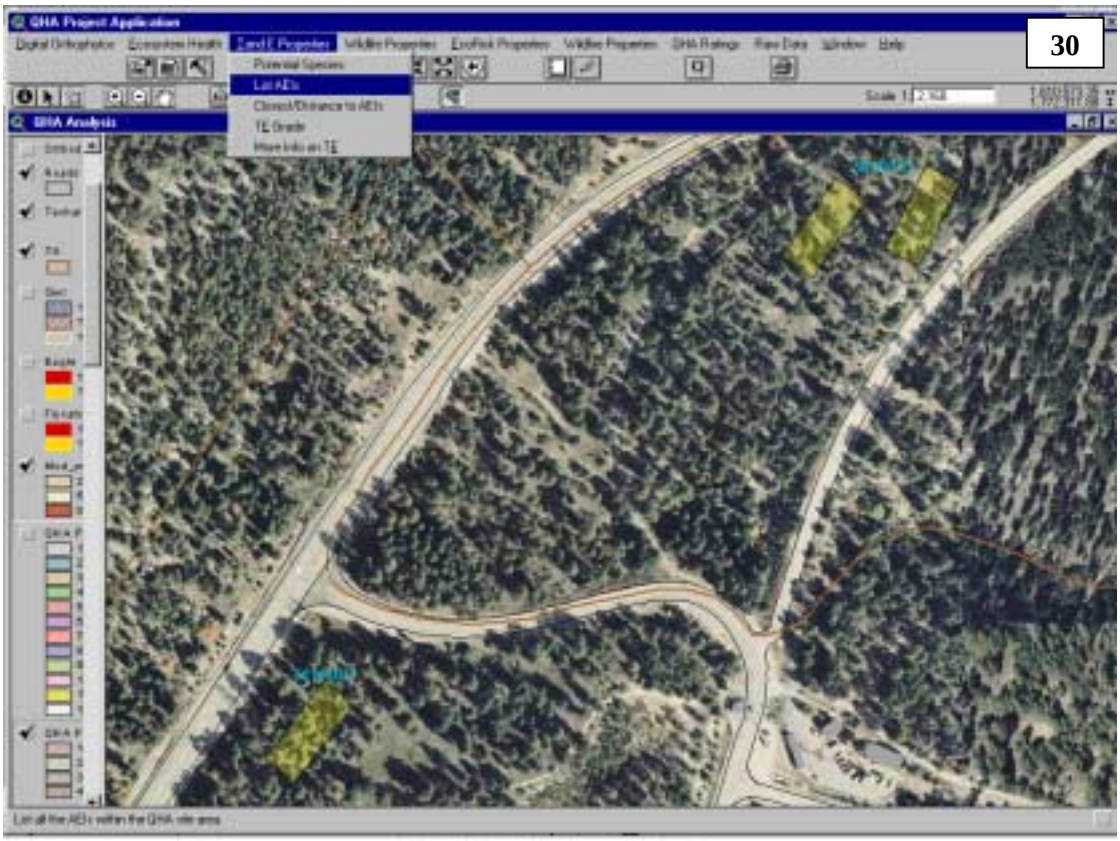
This selection generates a list of all federal and state protected species as well as species of concern.



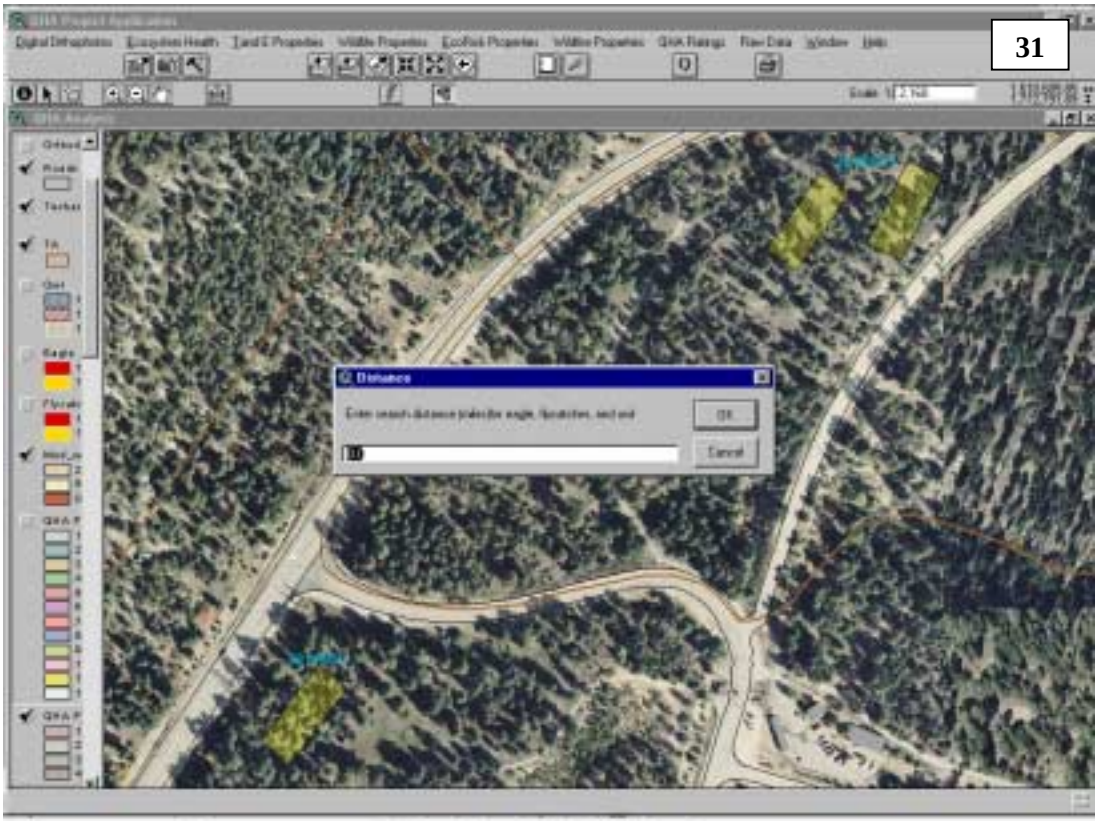
It will also bring up a table with highlighted records for your site area. This table includes more information about each species.



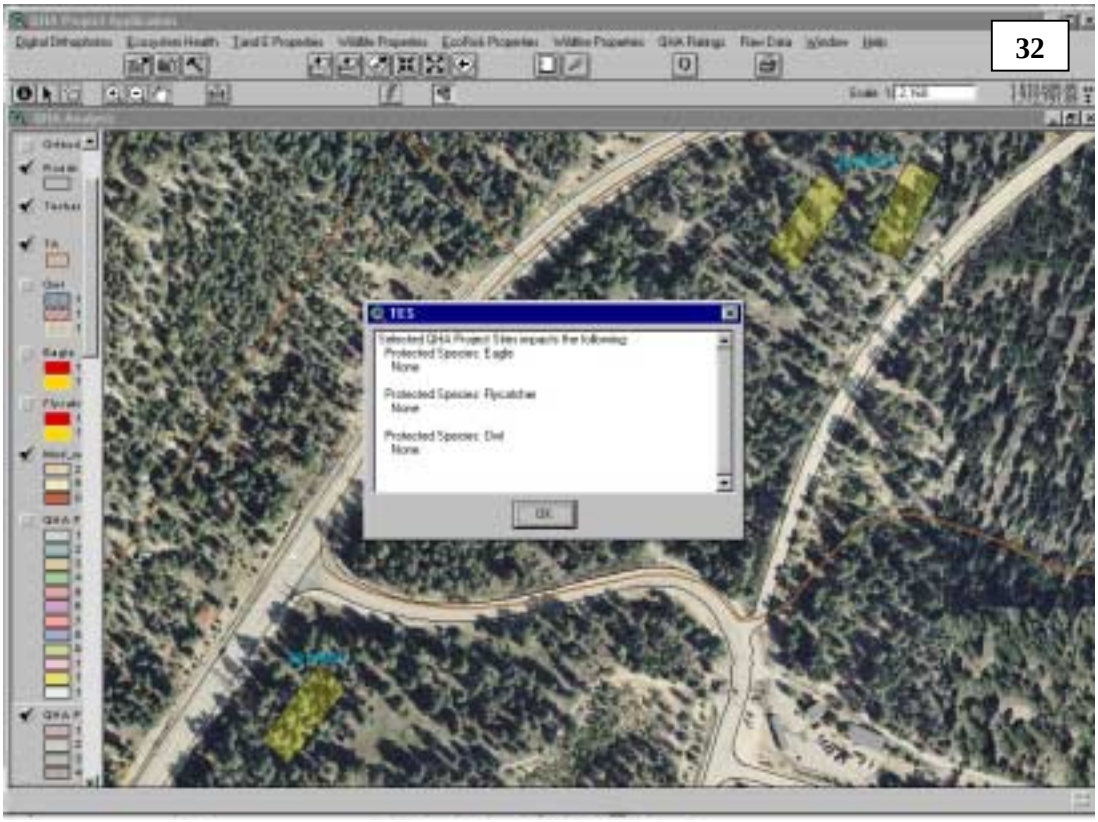
Close window when viewing is complete.



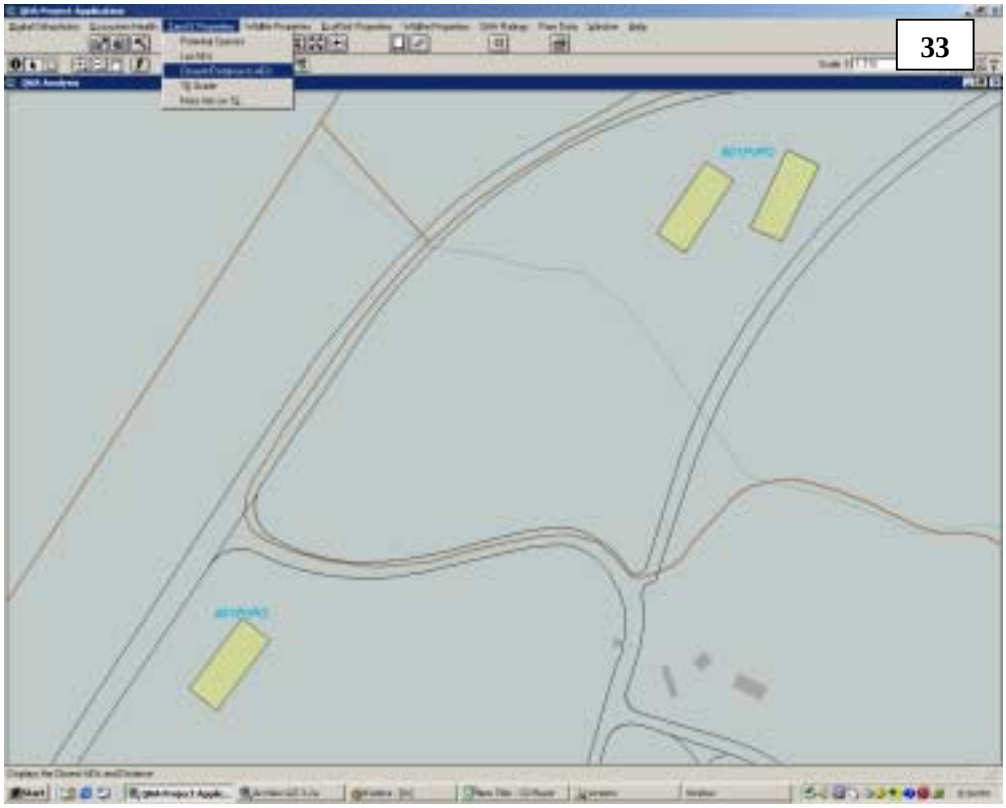
‘List AEIs’ will show any AEIs within the QHA Project.



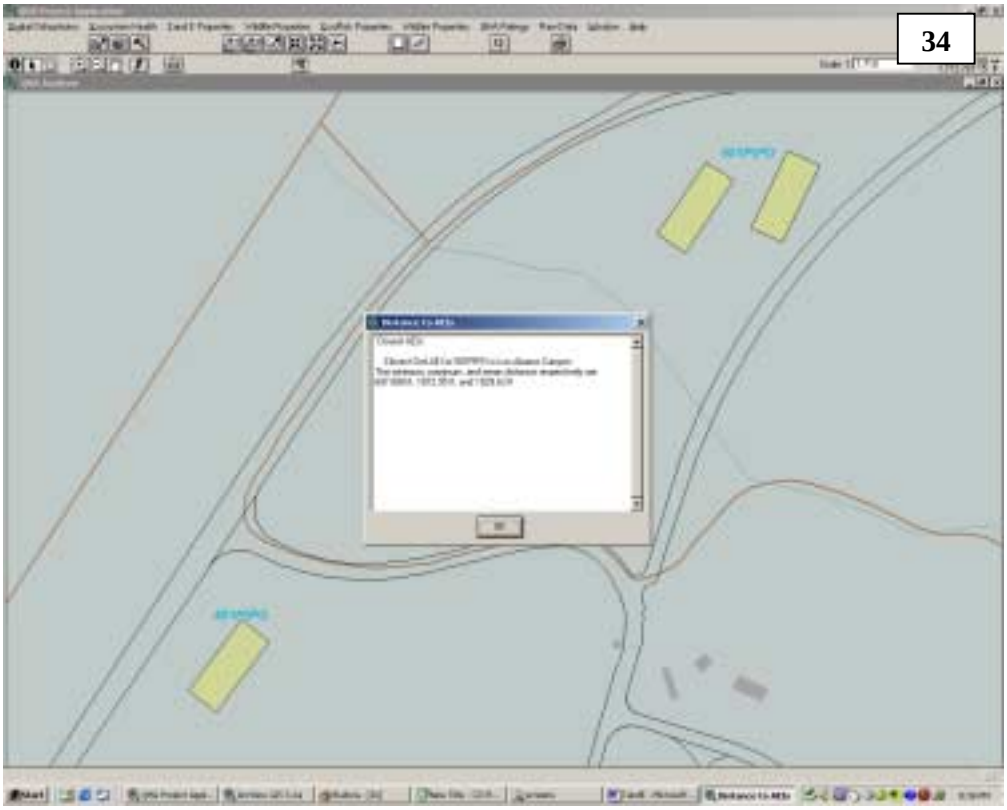
This pop-up window is shown three times (first time for eagle, then flycatcher, and the last time for owl). A different search distance can be entered for each species.



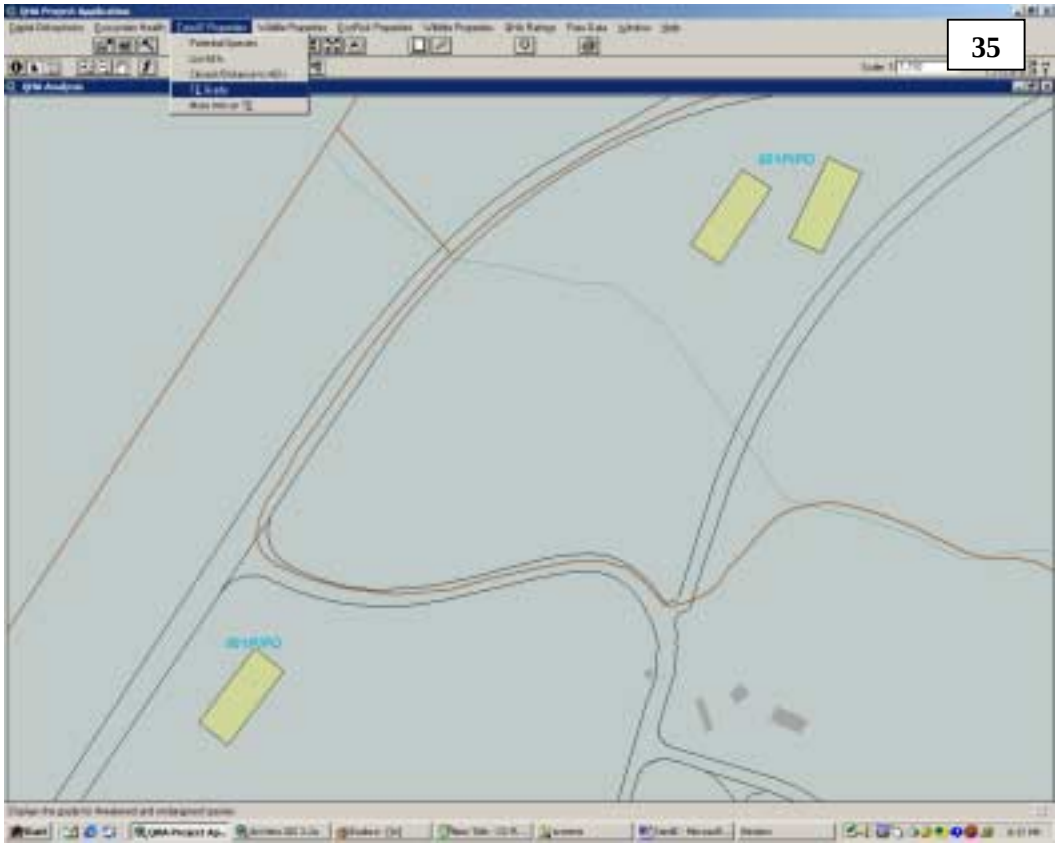
A pop-up window is brought up showing the AEIs by species.

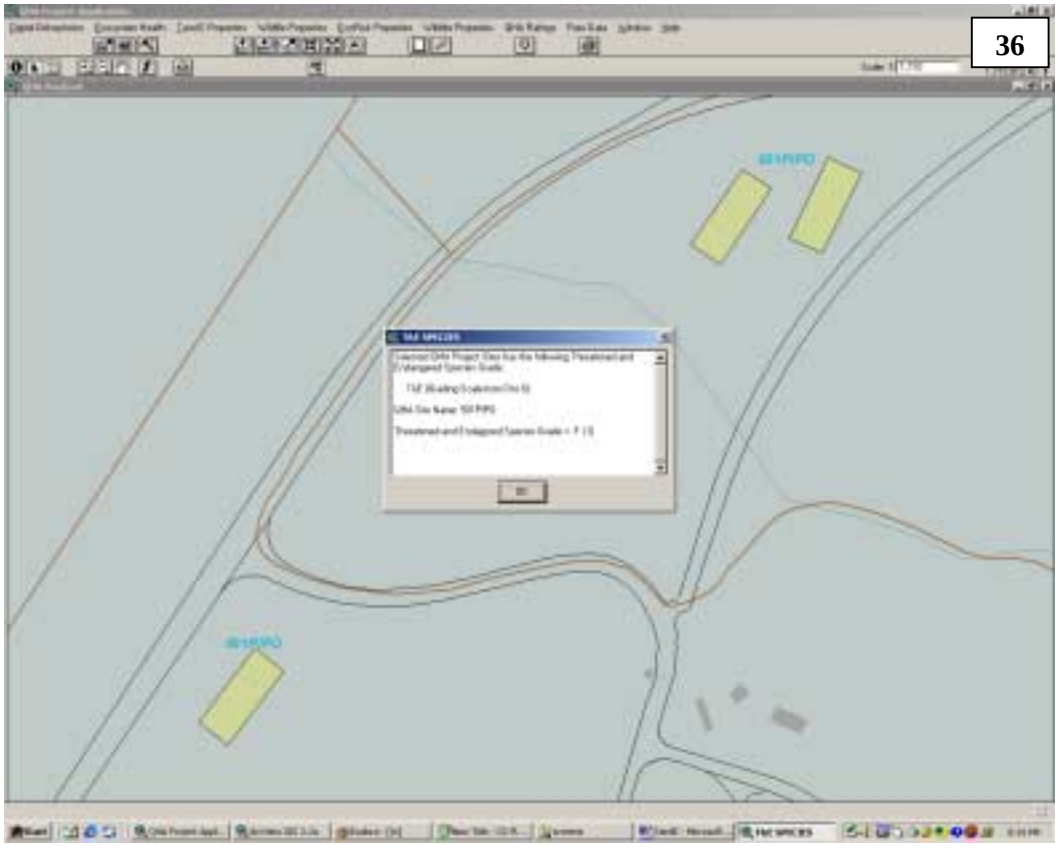


‘Closest Distance to AEI’ generates a pop-up window with information about the closest AEI to your QHA Site.

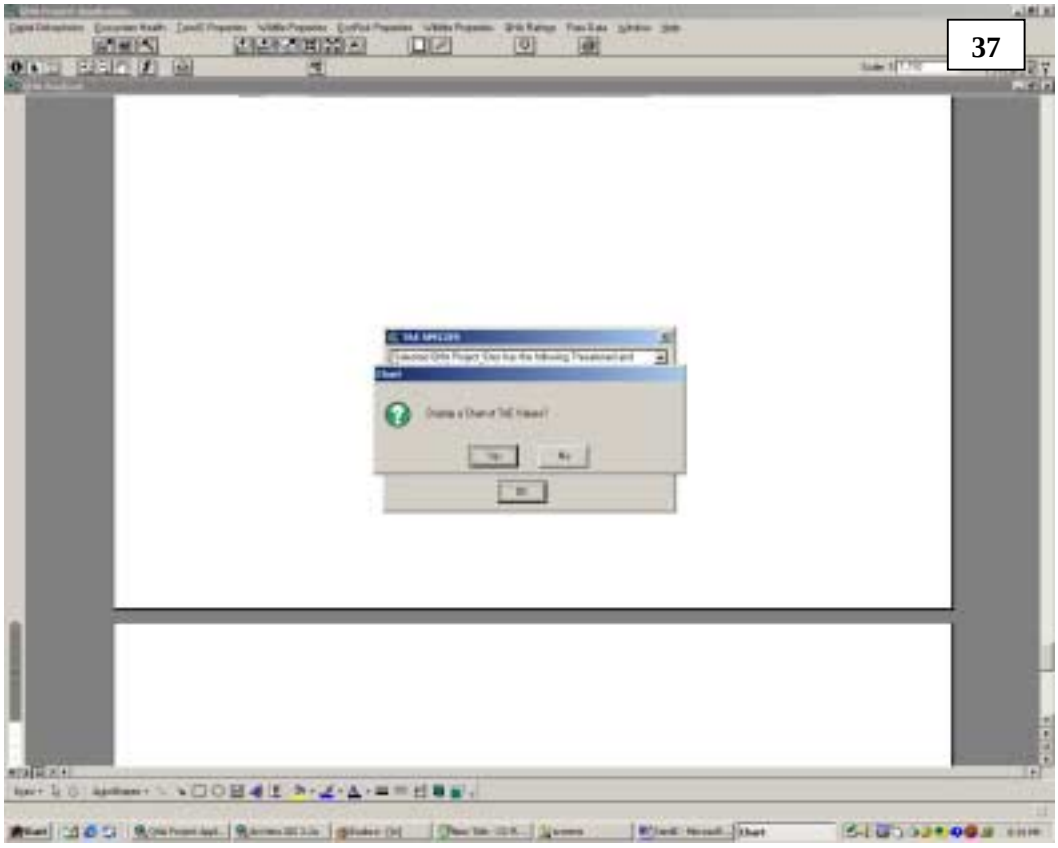


The pop-up window includes information on the mean, maximum, and minimum distances to the closest AEI.

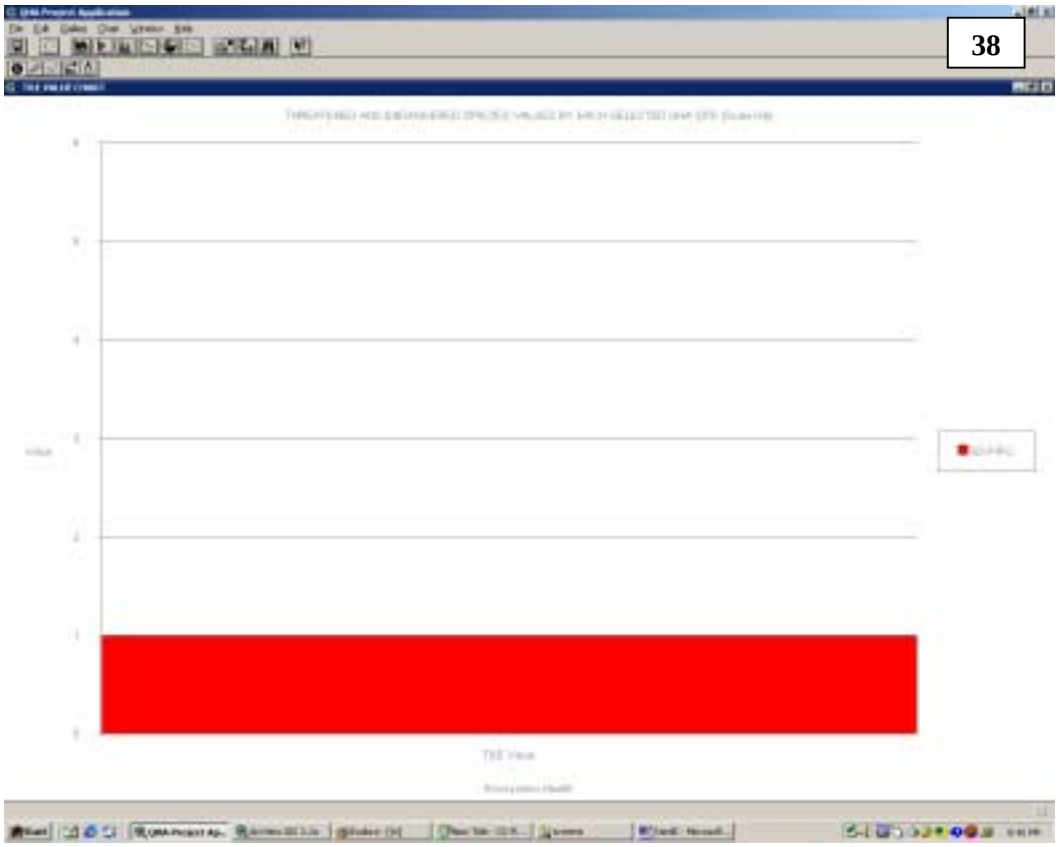




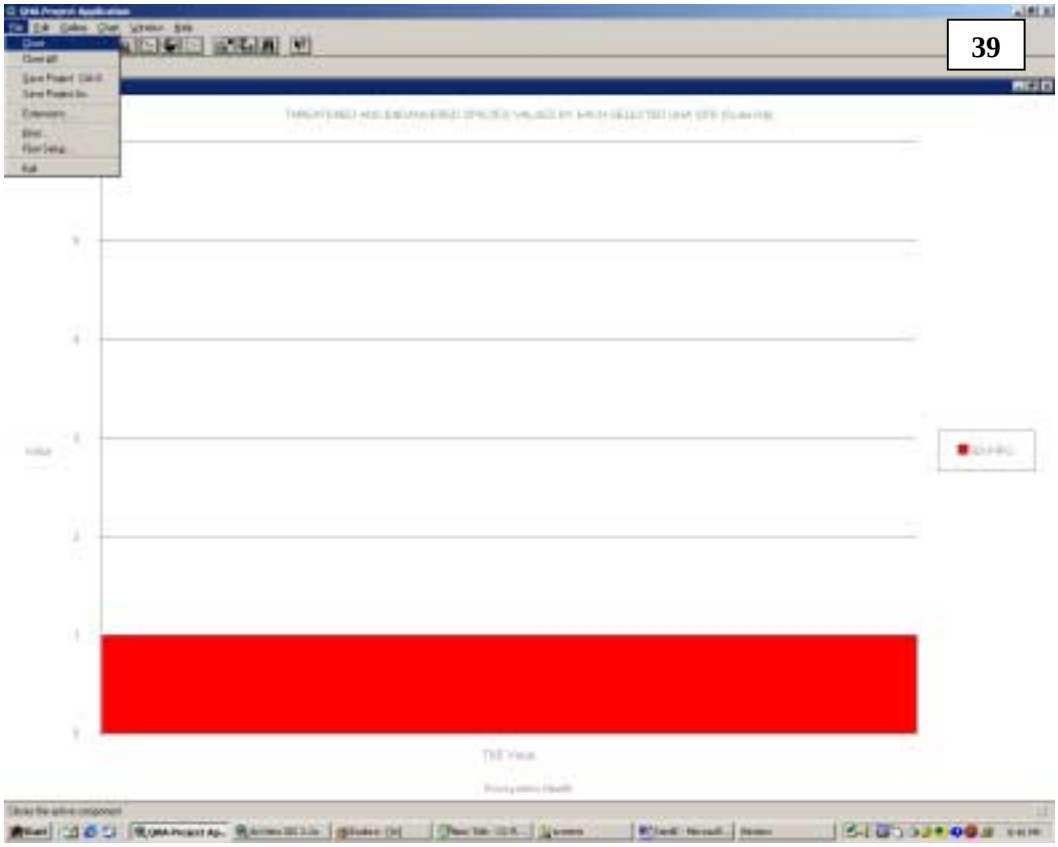
'TE Grade' for your QHA Site generates a pop-up window with the T&E grade.



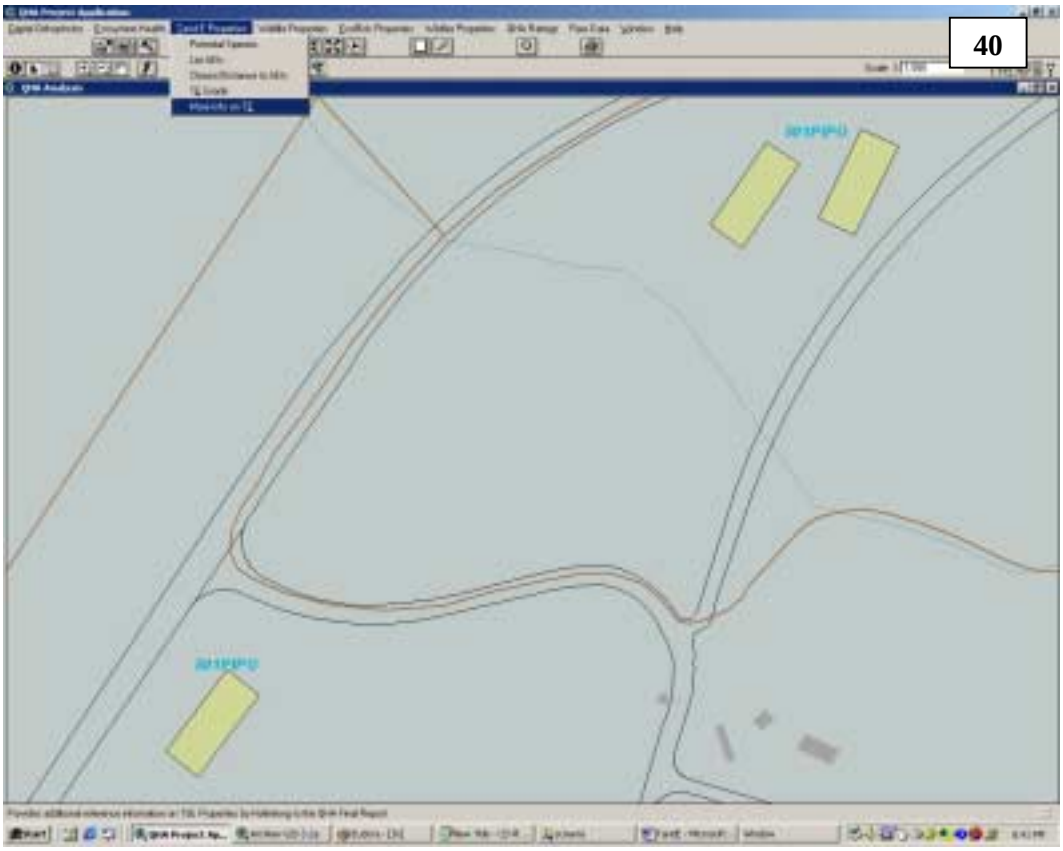
You are also prompted if you would like to display a chart.



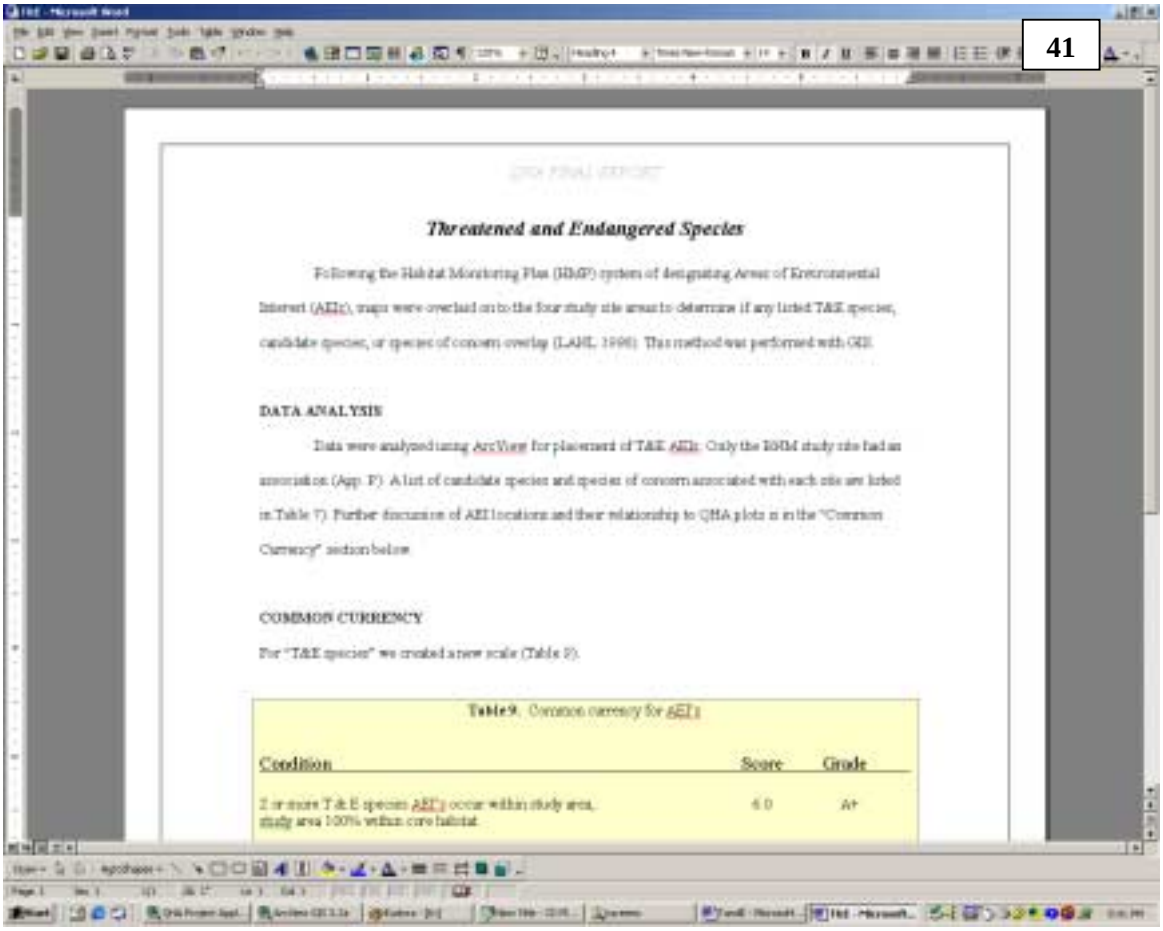
If you clicked yes, a chart will appear with the T&E value. Note the scale of the value (0 to 6).



Close chart when viewing is complete.



'More Info on TE' opens a Word document giving additional information on the T&E properties.



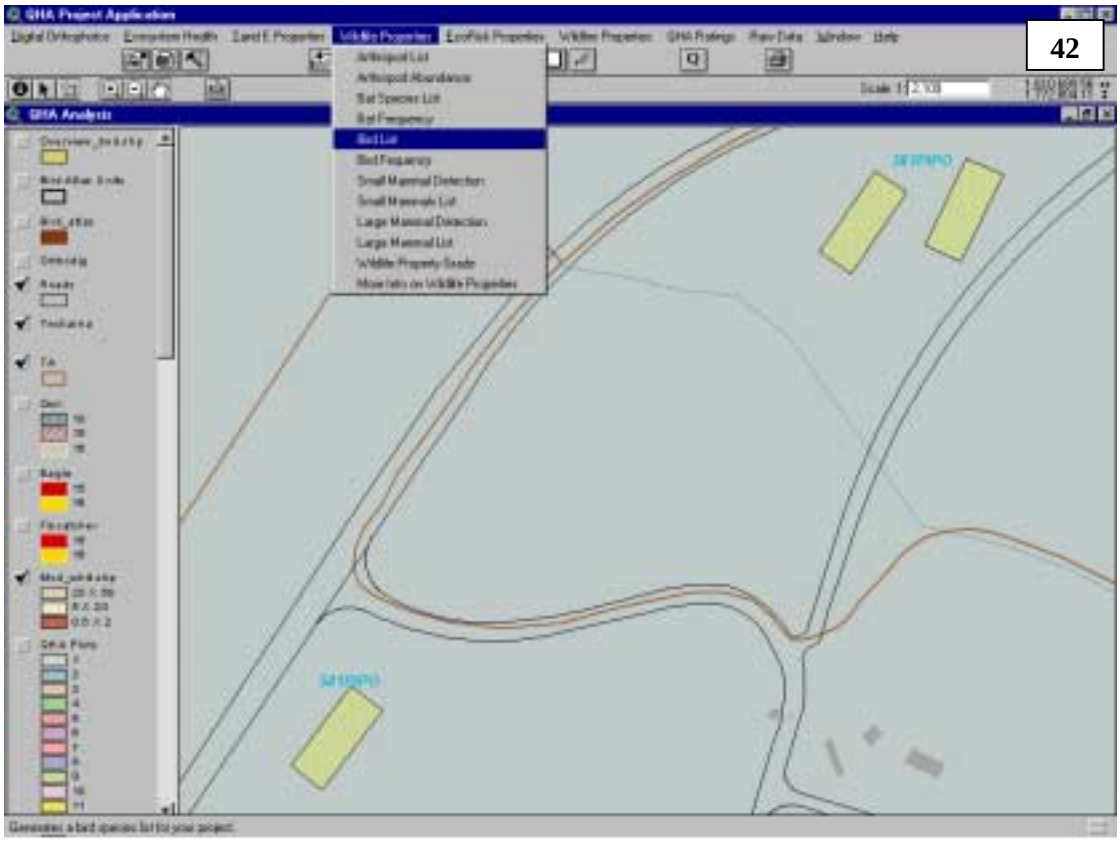
Close Word when viewing is complete and you will be back in ArcView.

Figures 42–53. Wildlife Properties have several items that can be chosen. For demonstration purposes, we will look at birds that occur within the QHA study area (42).

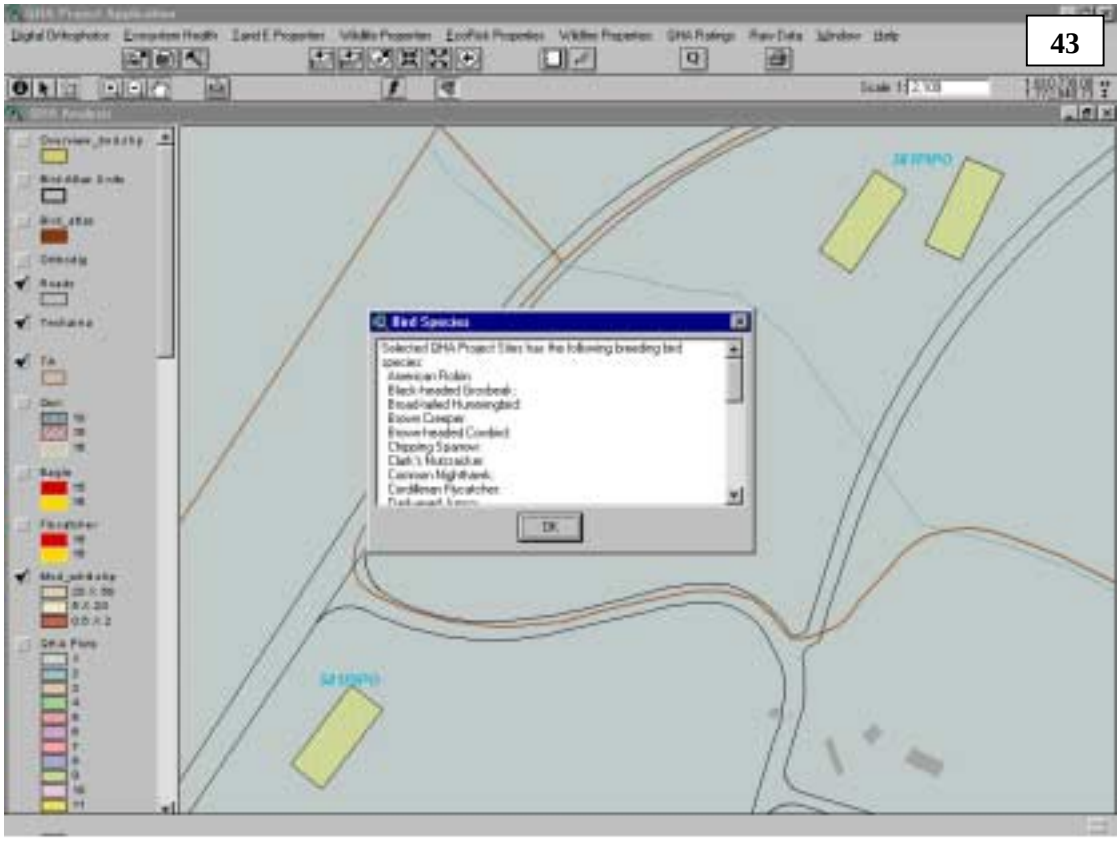
First, a bird list comes up (43) that corresponds to species in the region based on the Breeding Bird Atlas. If more information is desired, then a tabular view of all the species can be selected (44 and 45).

A grade can be obtained for the wildlife section as well (47), based on all of the wildlife species and parameters considered in this section. It is displayed in a pop-up box (48). A chart can be drawn for the data in each of the grade sections, but in some cases, like here, if only one score is given, then the chart becomes unnecessary (49–51).

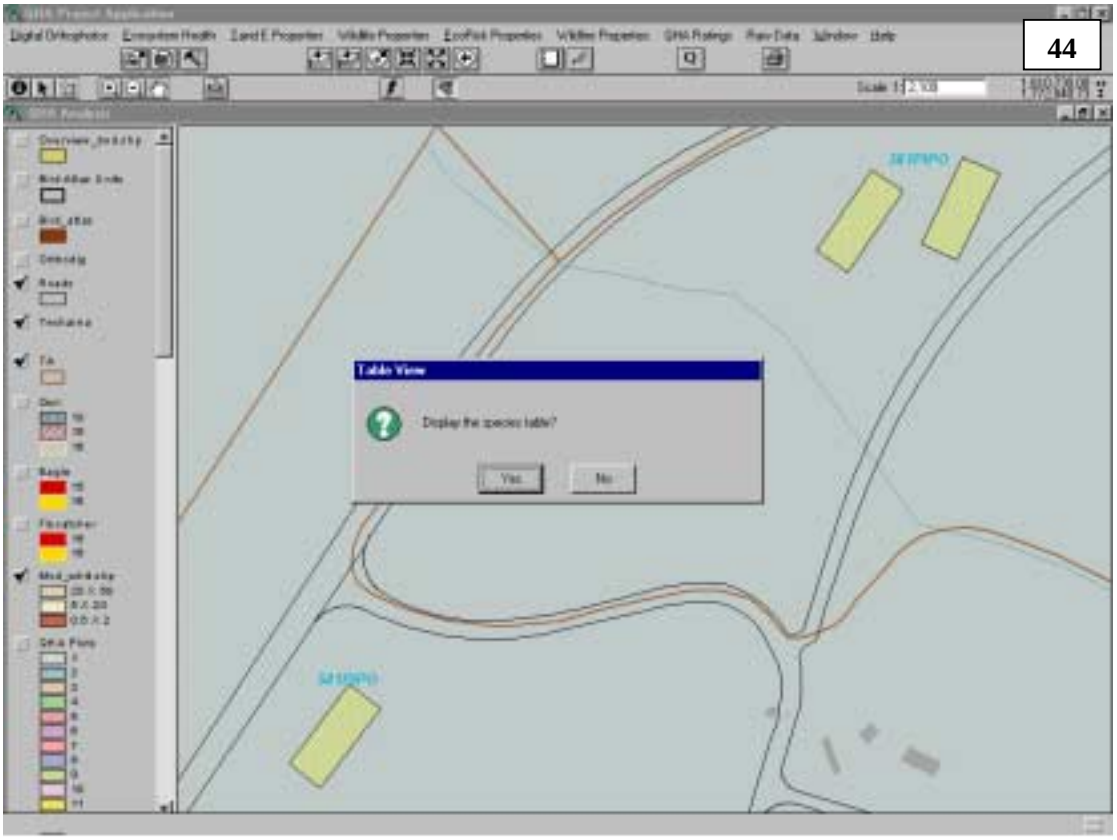
Like the other sections, 'More Info' can be obtained about the properties in question (52).



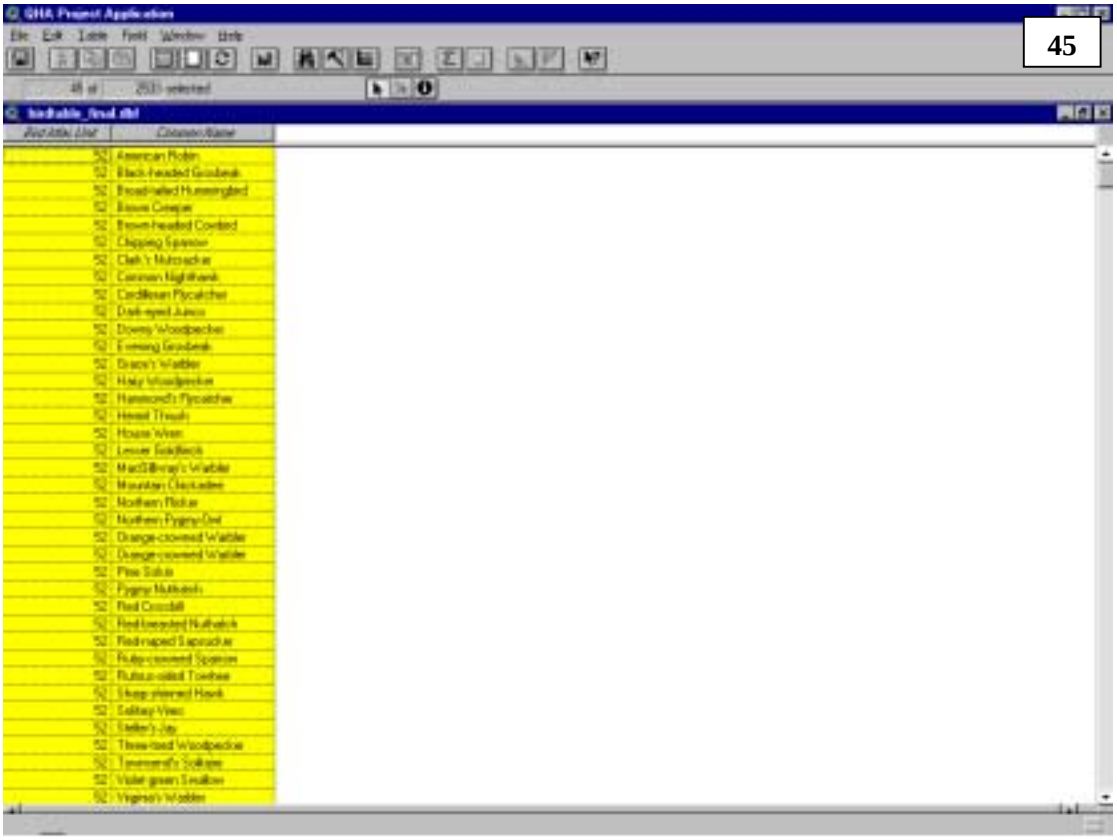
Wildlife Property Bird List



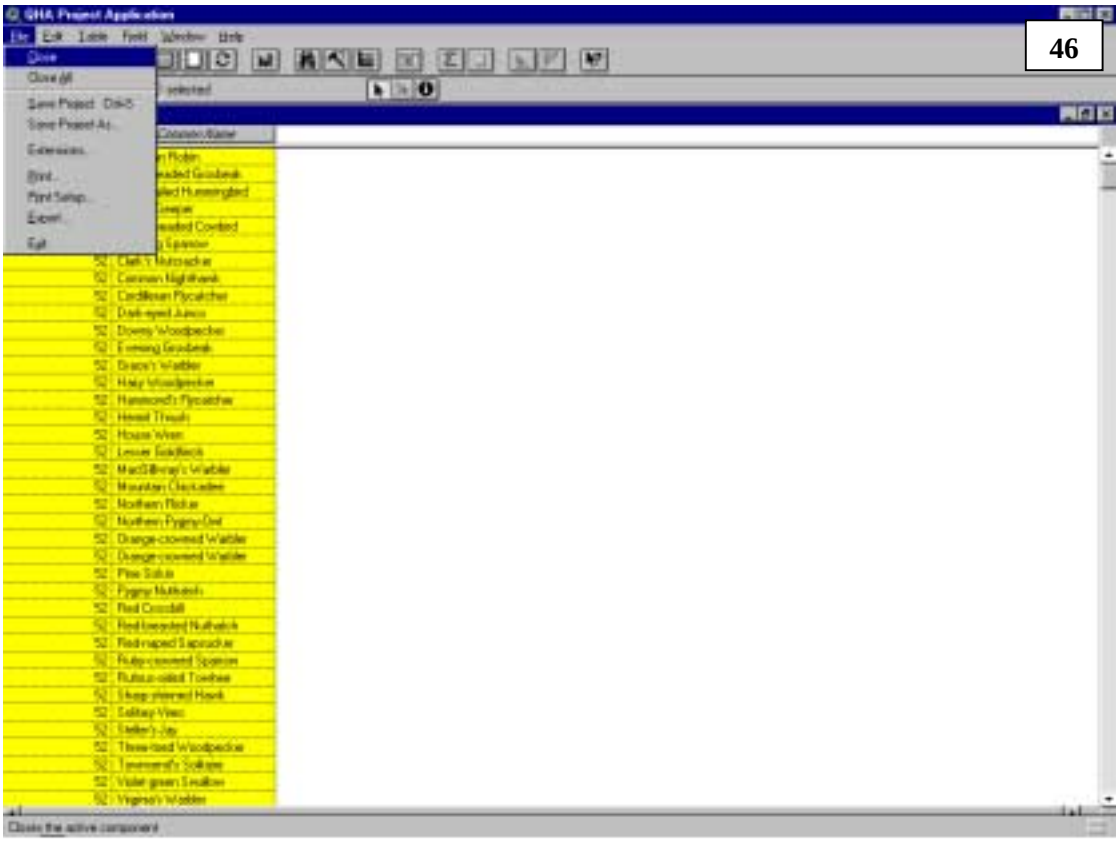
Display Pop-up Window of Birds



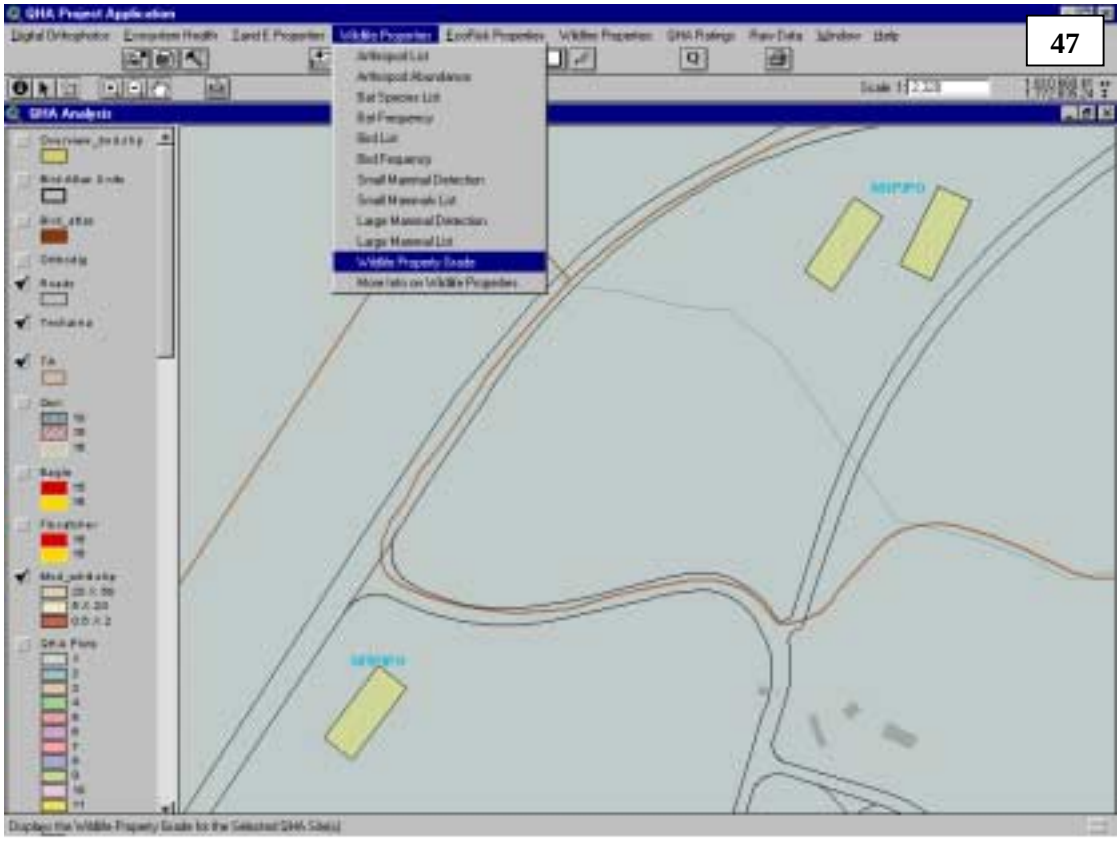
Display Table



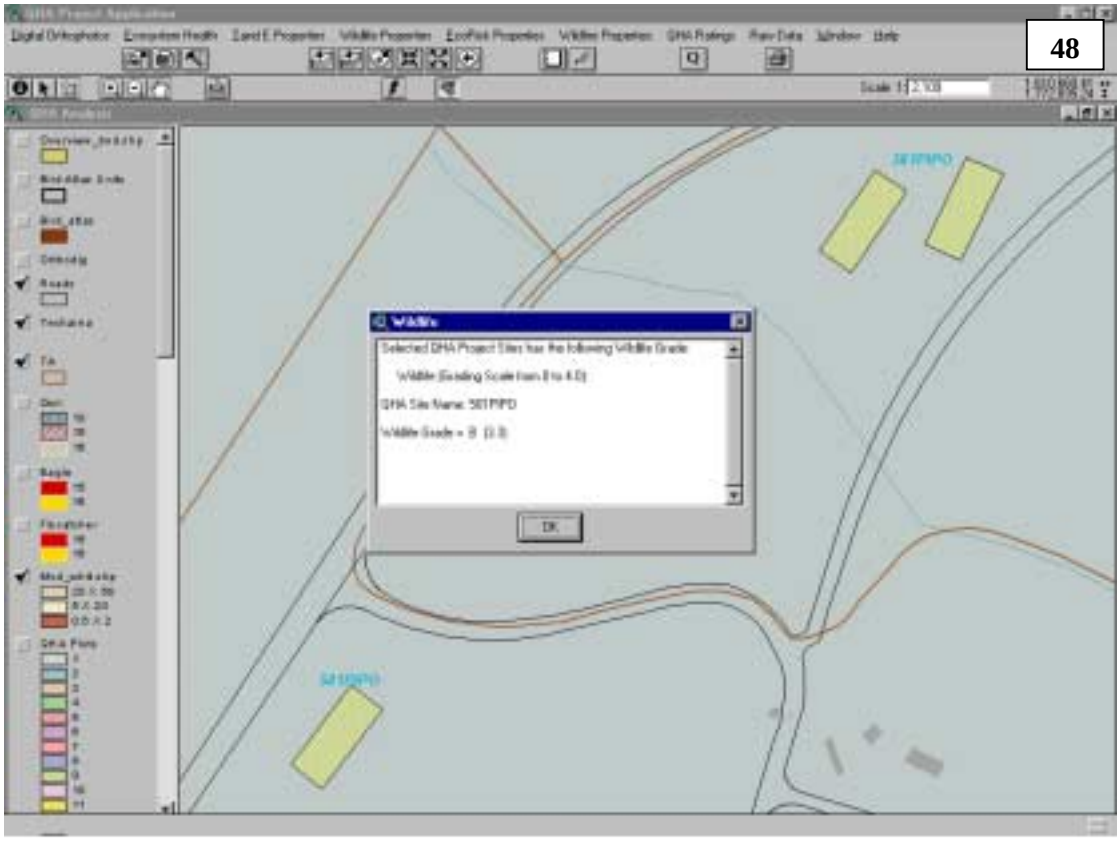
Display the selected records in the table



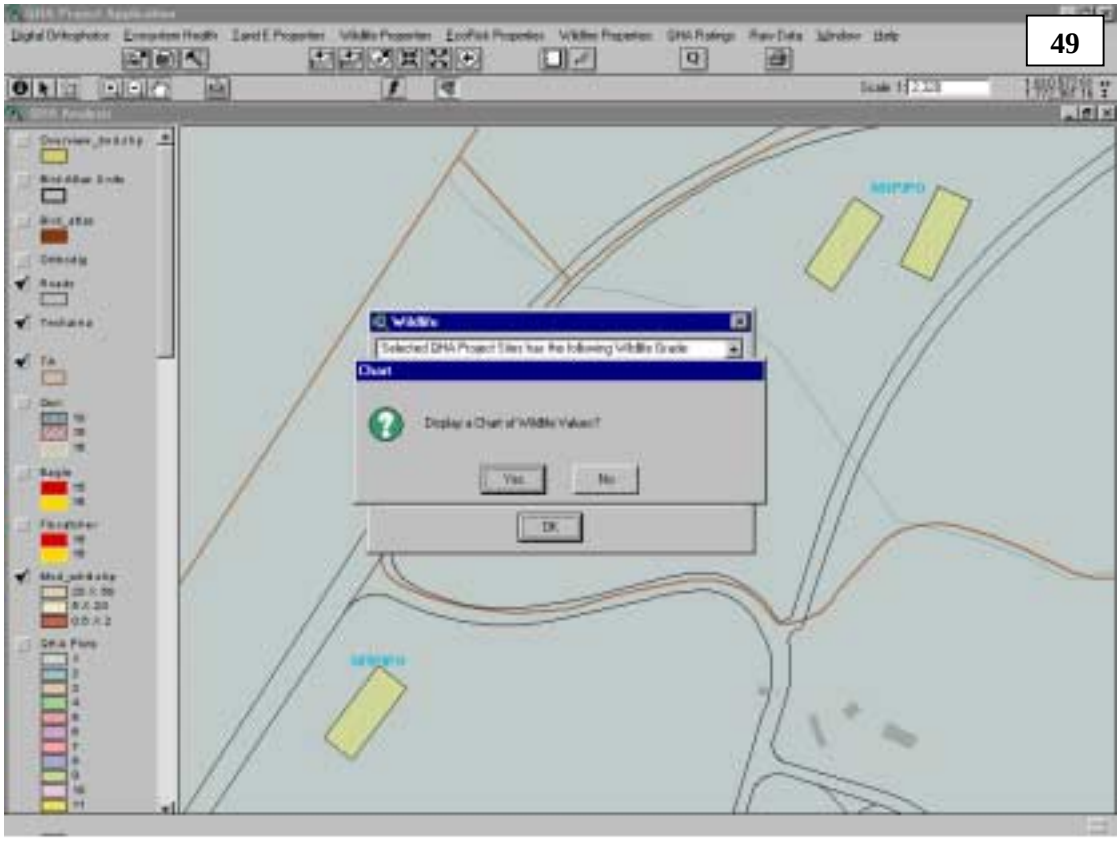
Close table



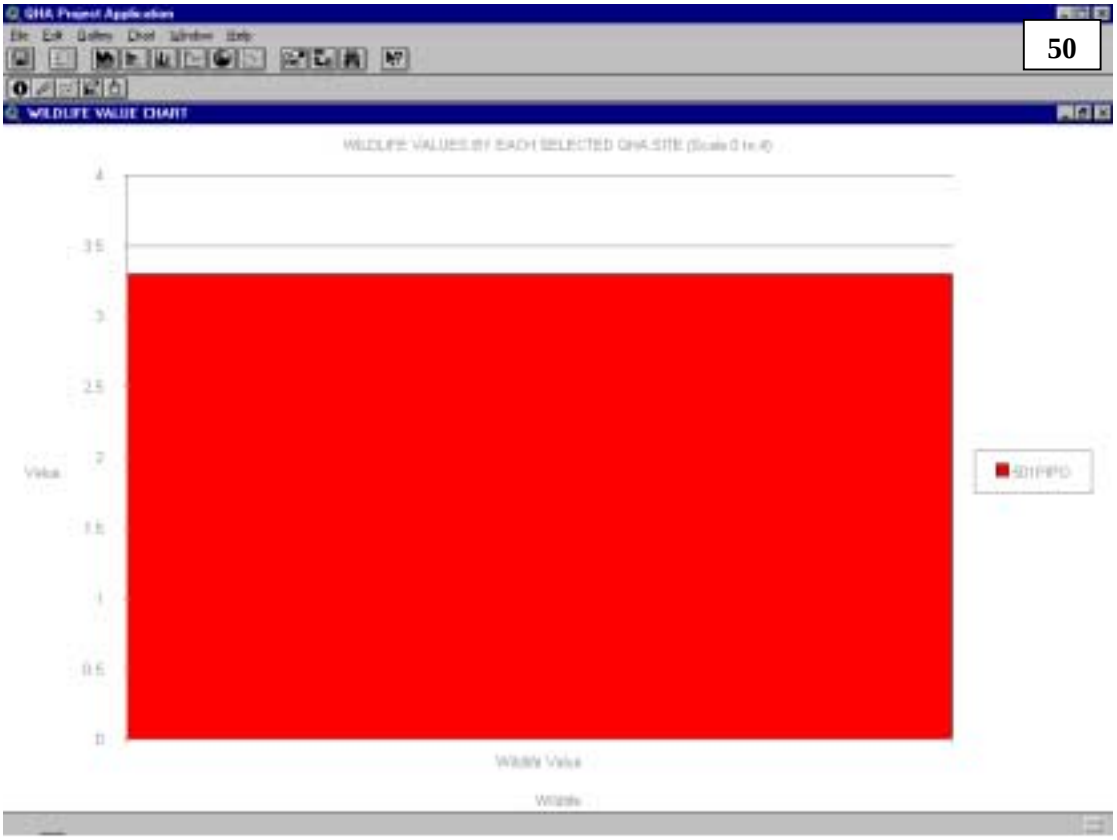
Wildlife Property Grade

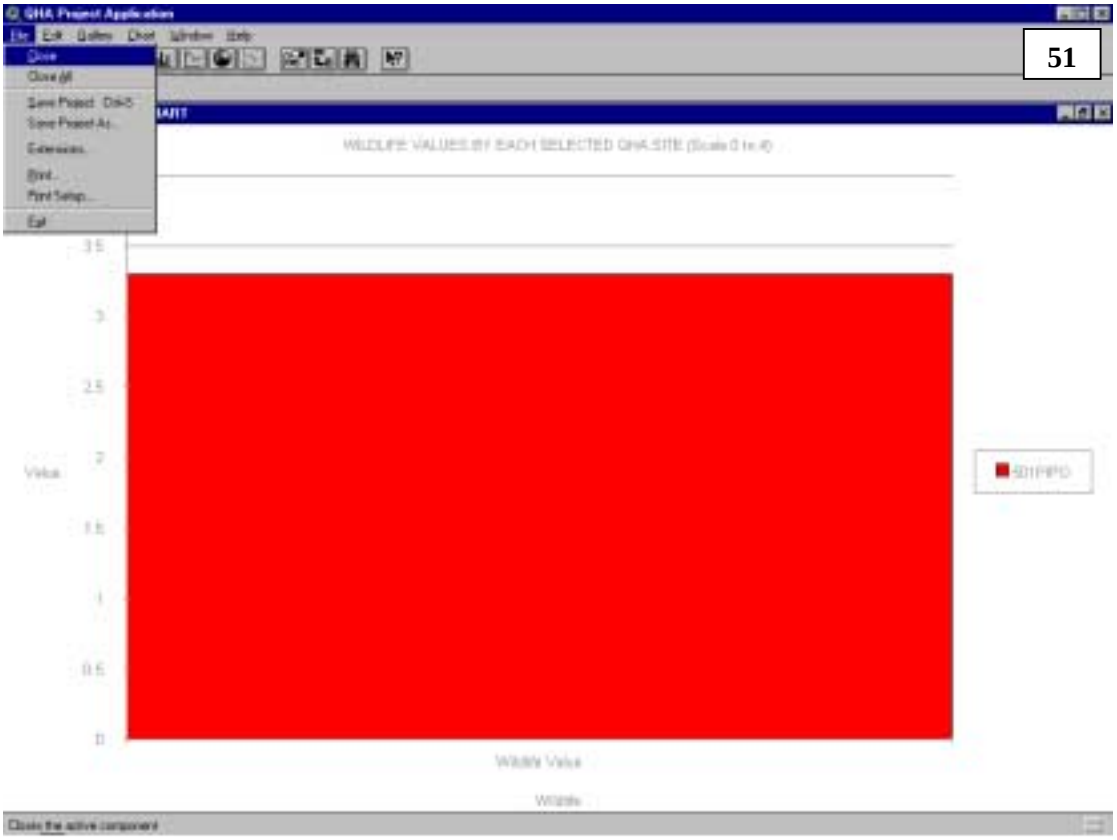


Pop-up Window with Grade

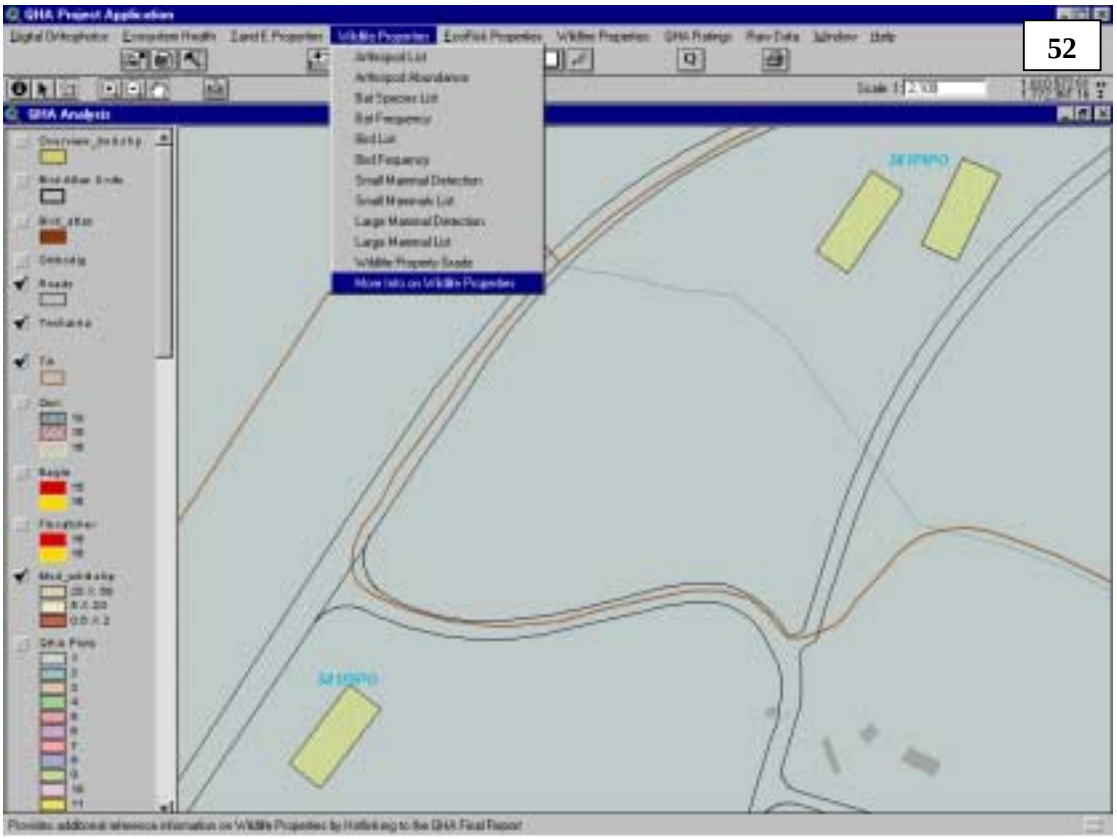


Display Chart

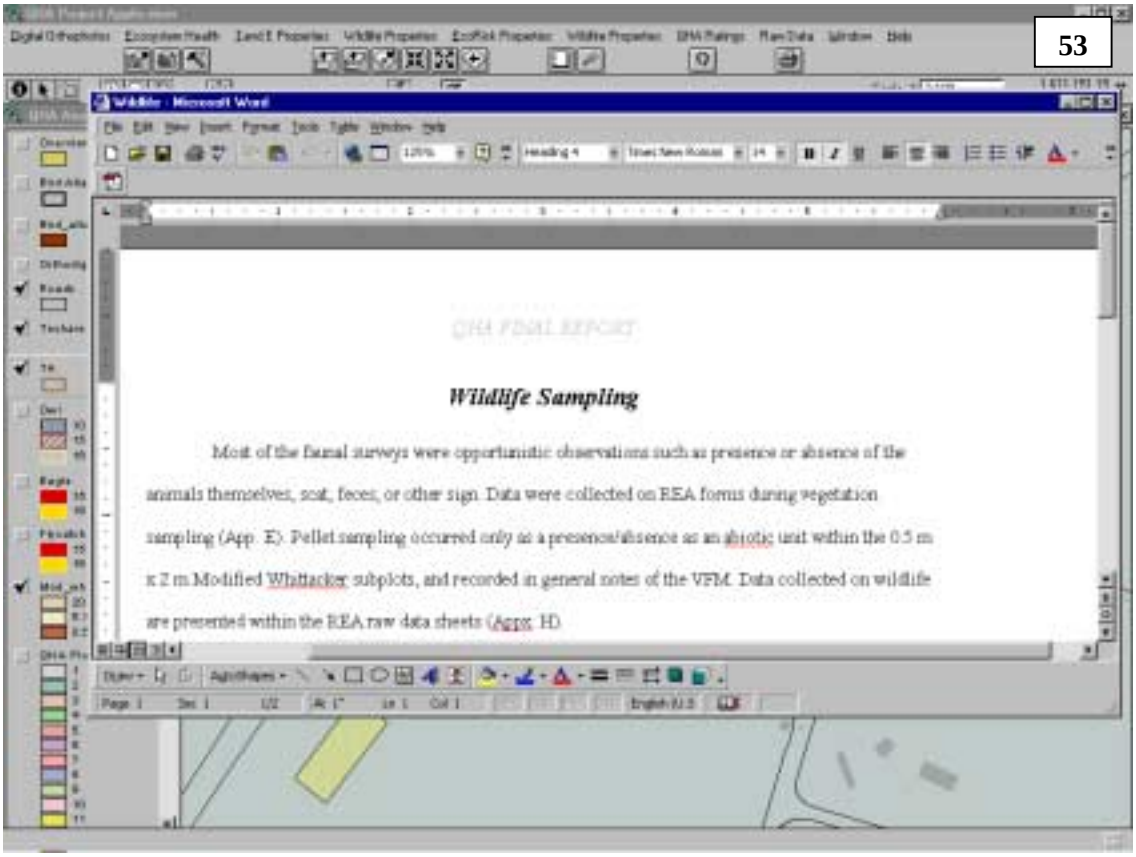




Close chart.

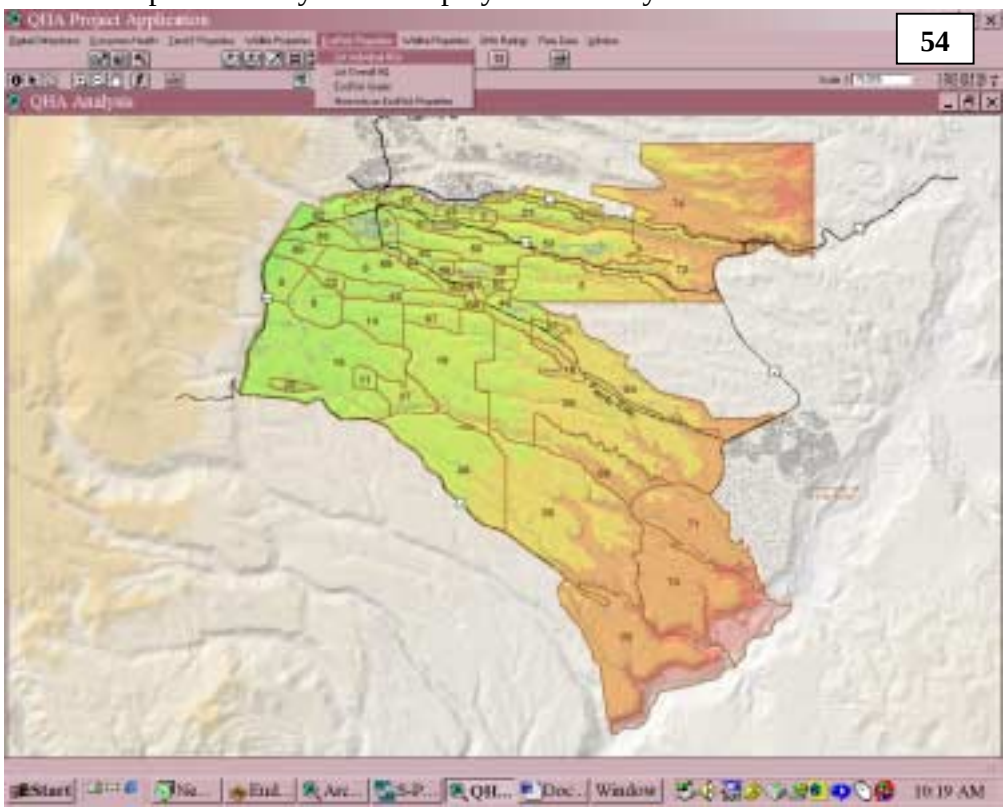


More Information on Wildlife Properties

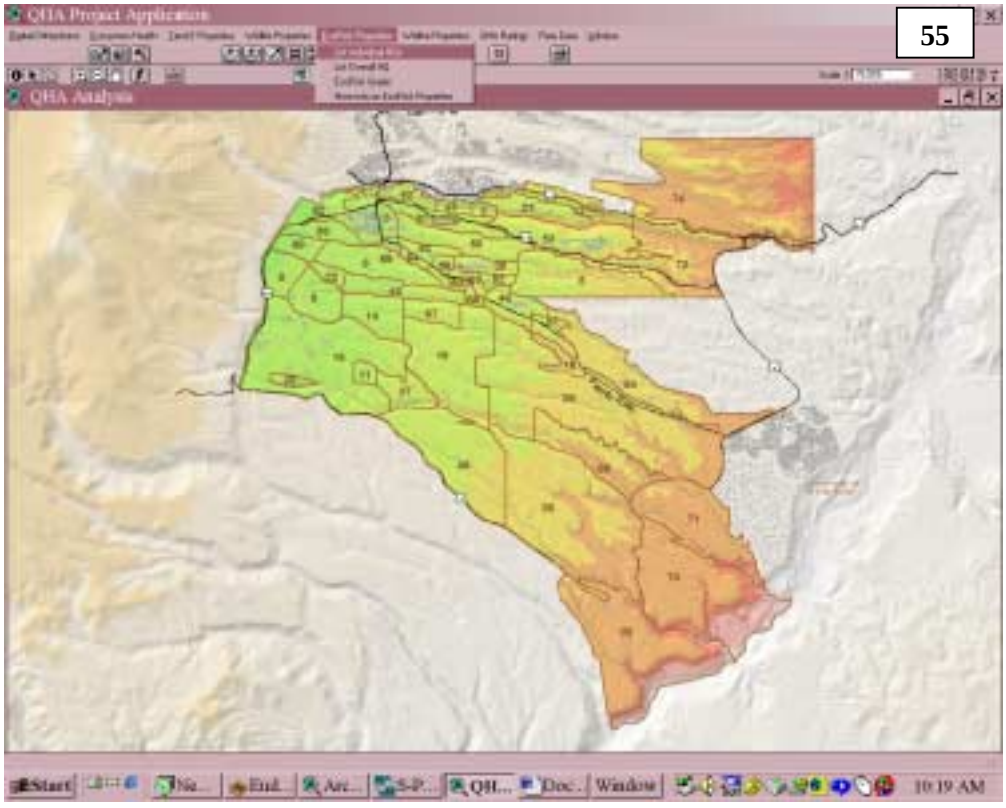


Word file of Wildlife Info from QHA Final Report

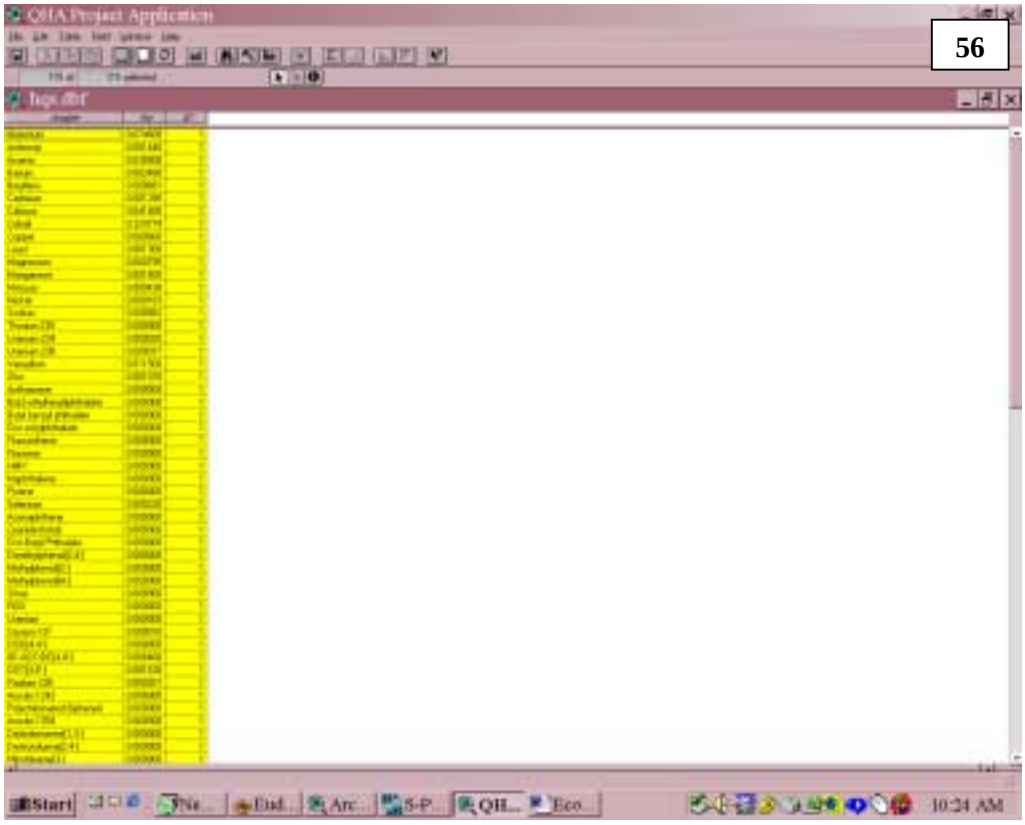
Figures 54–64. EcoRisk windows are similar to the last two categories. Here, hazard quotient (HQ) values for specific analytes are displayed and analyzed in relation to the site selected.



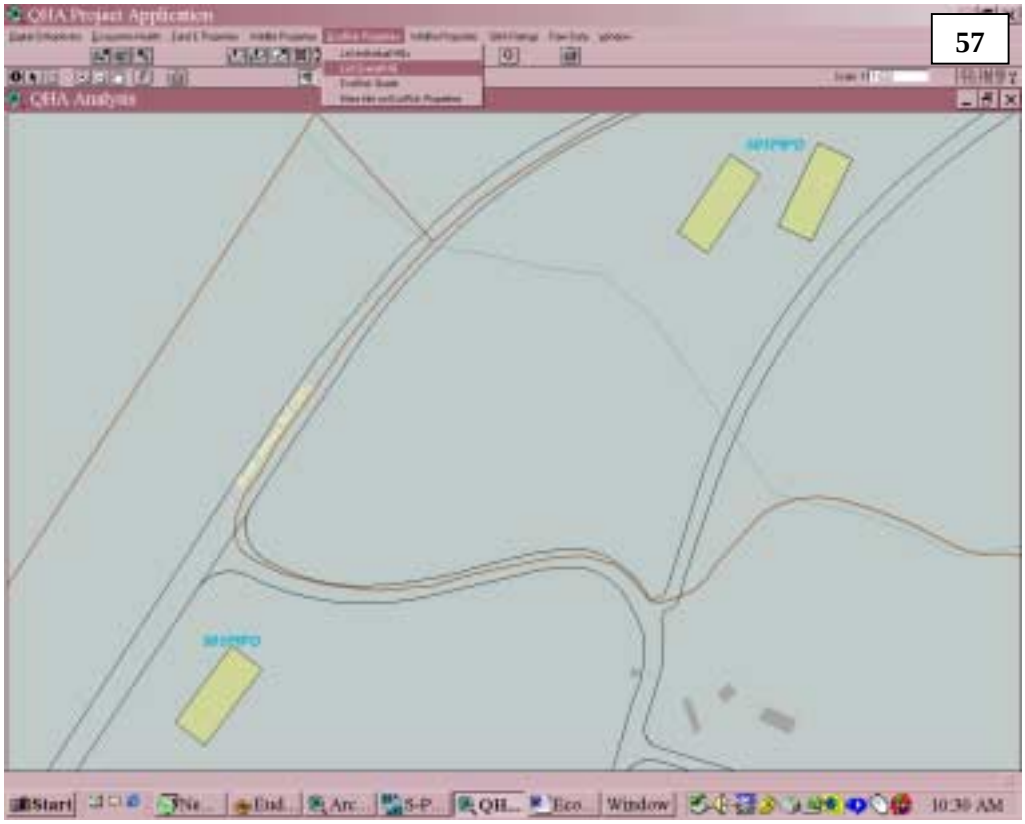
EcoRisk Pull Down Menu



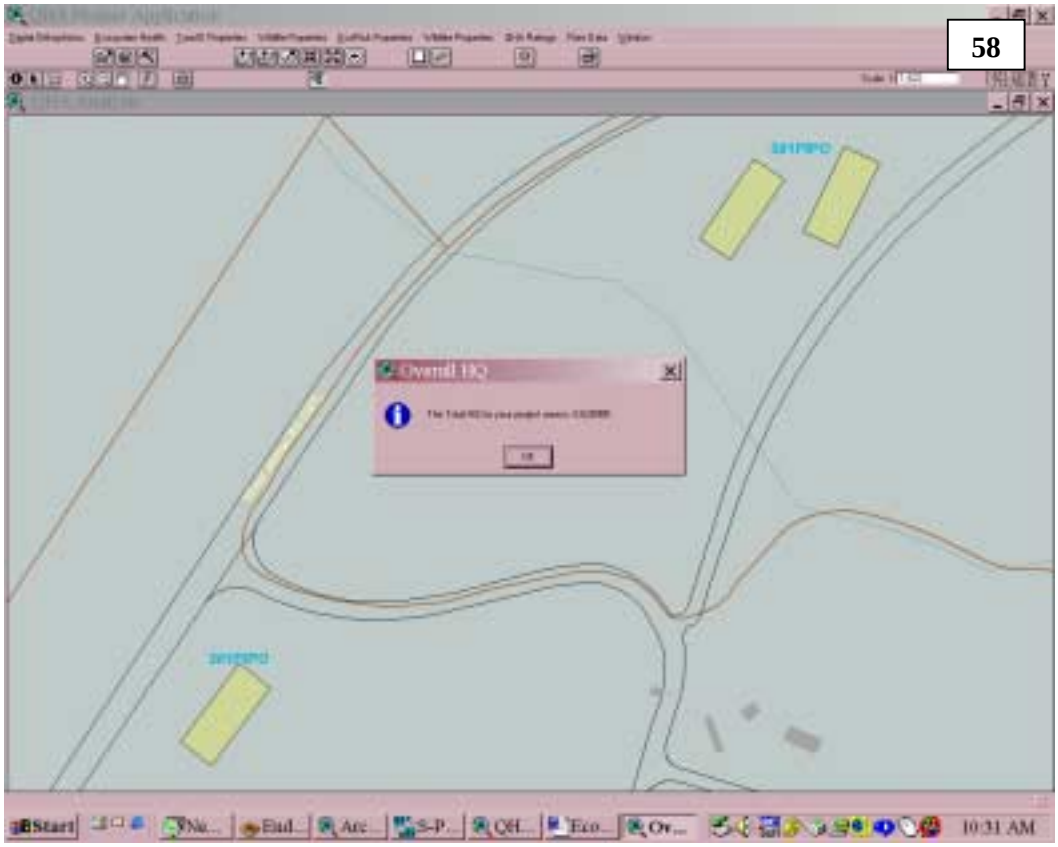
List Individual HQs for a QHA Site



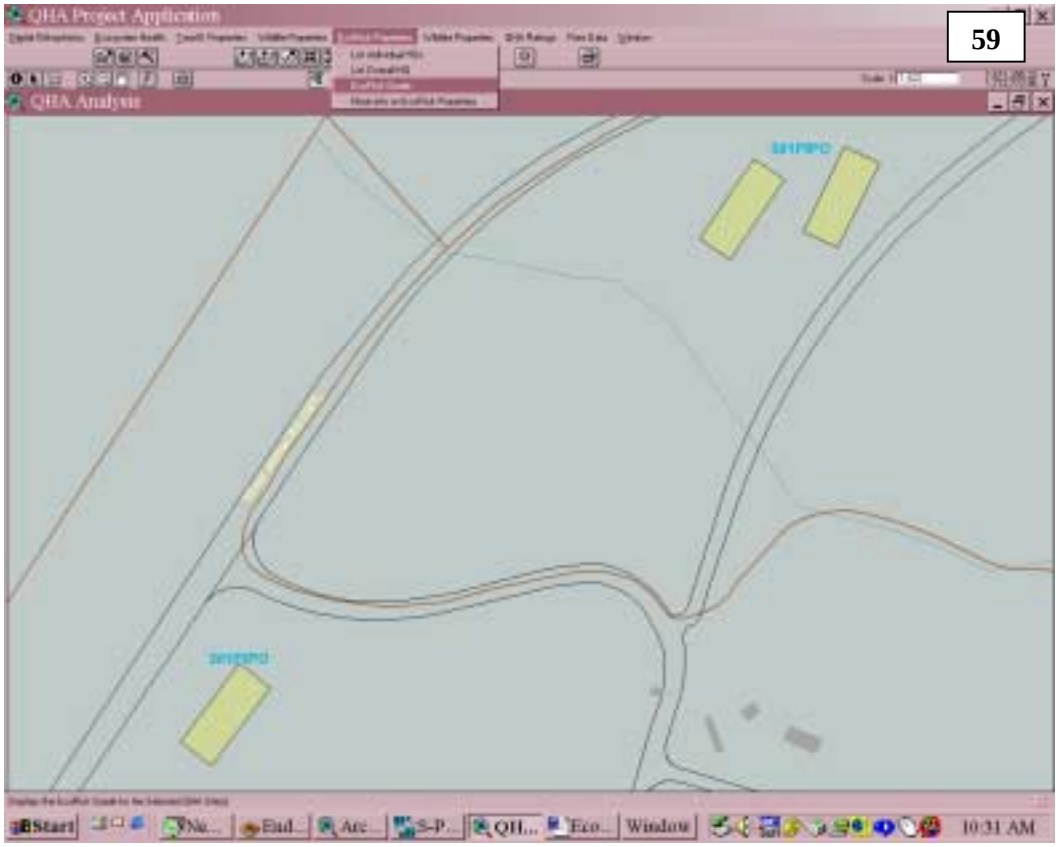
This selection opens up a Table with Analytes and their HQ values. Close table when viewing is complete.



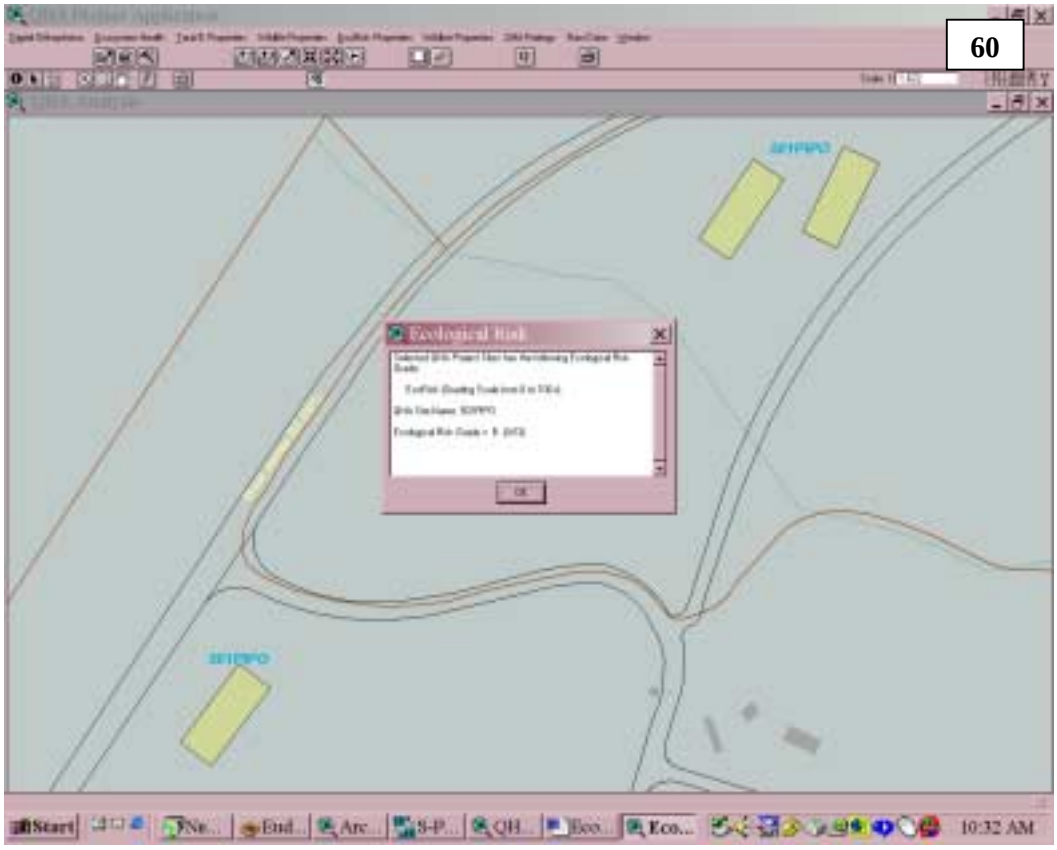
'List Overall HQ' displays the overall HQ for the QHA Site.

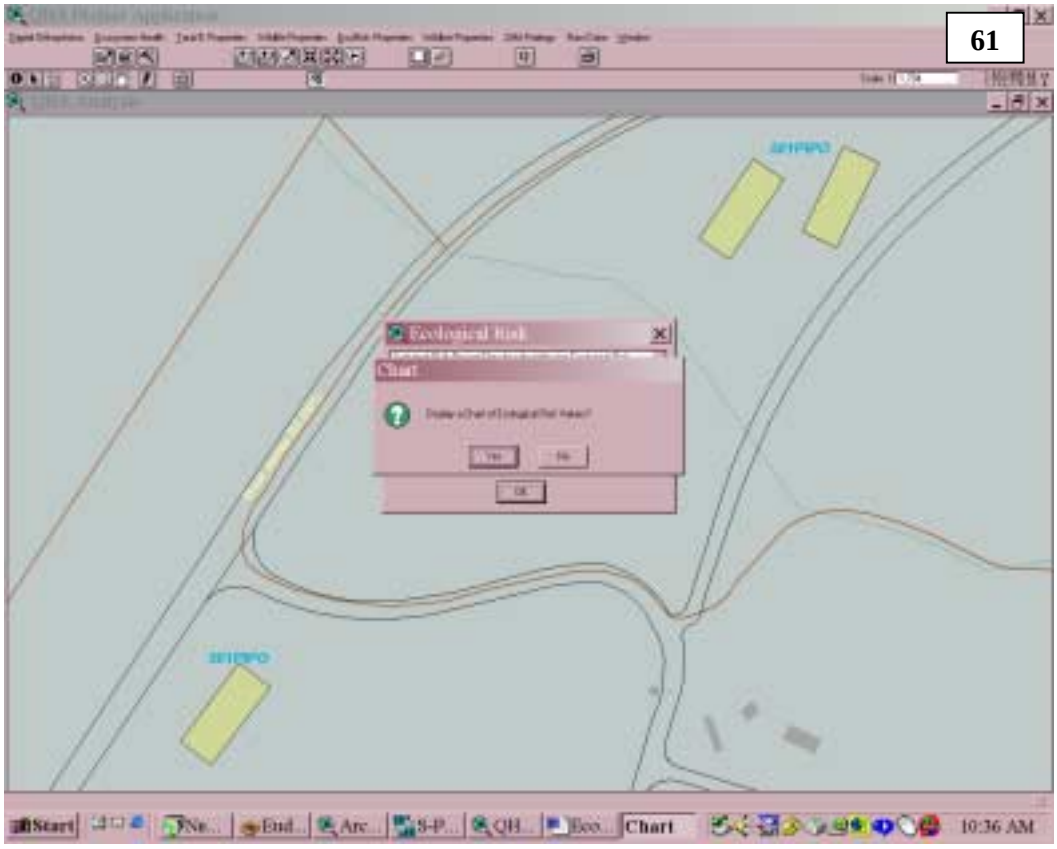


Pop-up Window with the Overall HQ for the QHA Site. Click OK when viewing is complete.



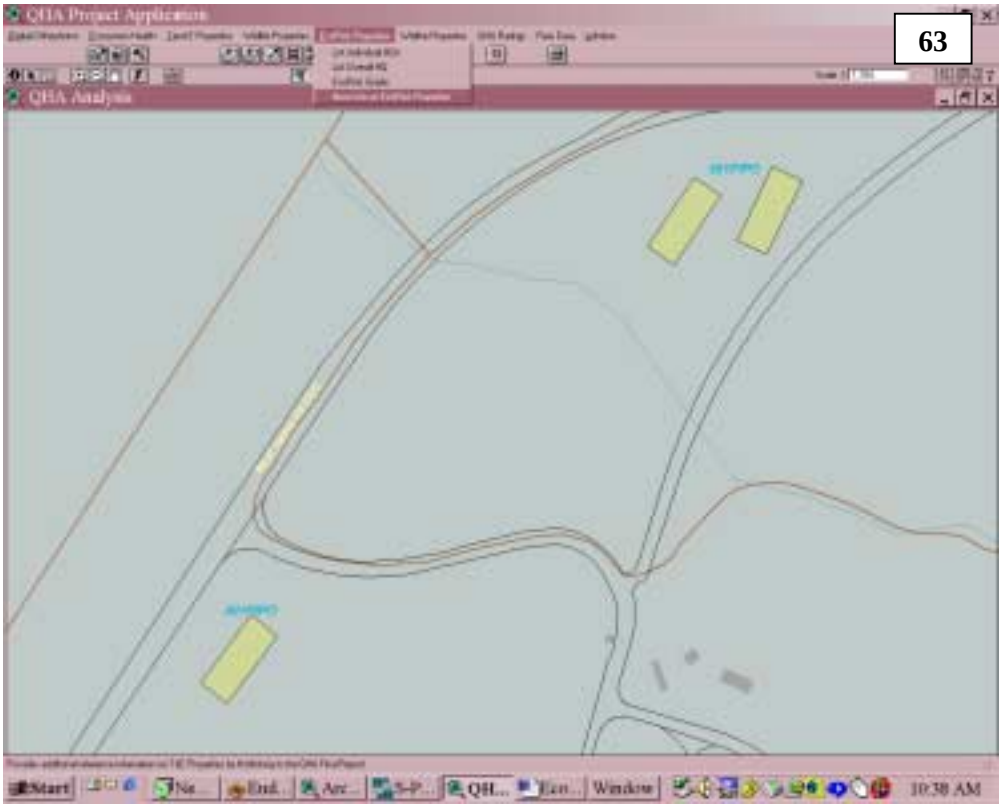
EcoRisk Grade displays a pop-up window with the grade—click OK when viewing complete.



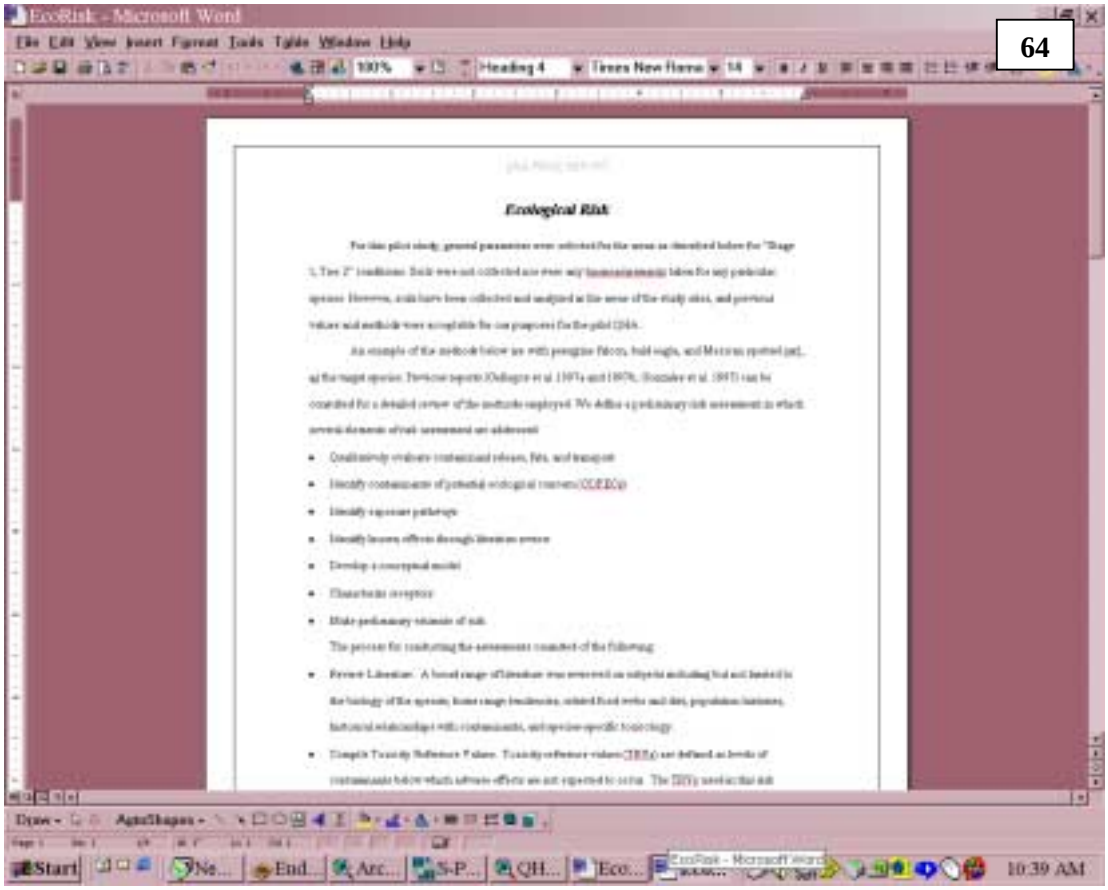


Display a Chart of EcoRisk Values?

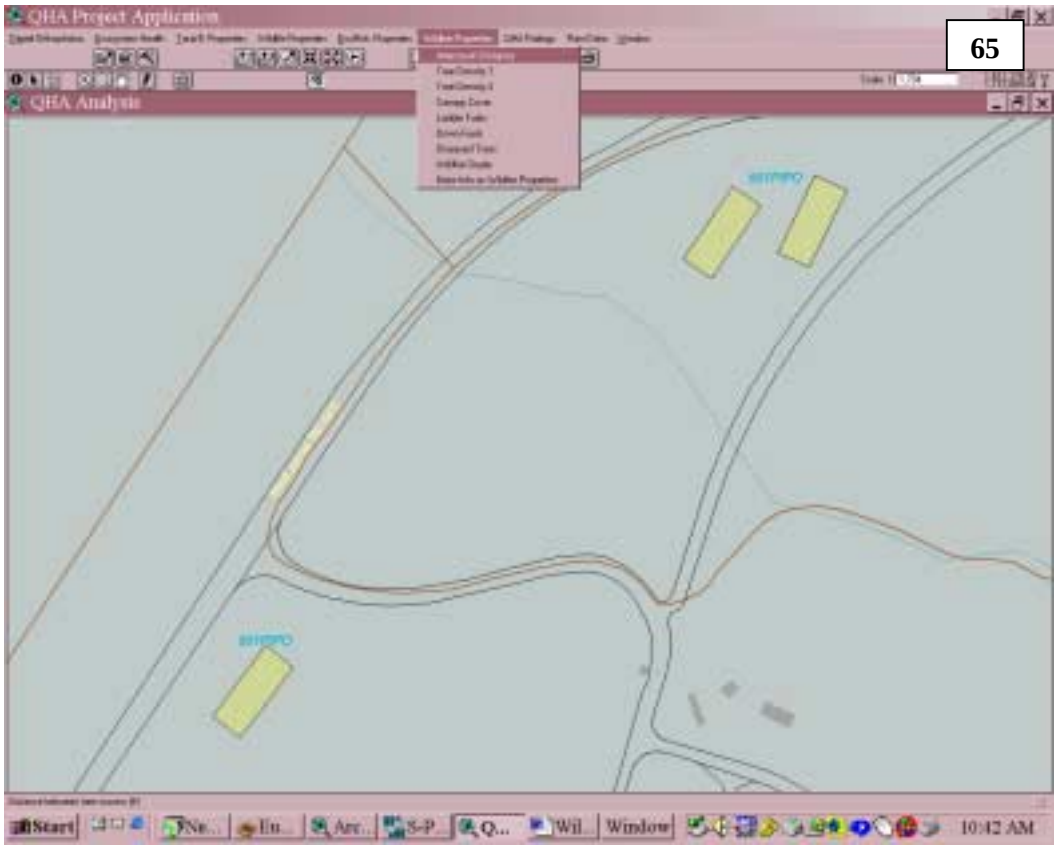
Chart of EcoRisk Values—Note that scale has an inverse relationship (the lower the value the better). Close chart when viewing is complete.



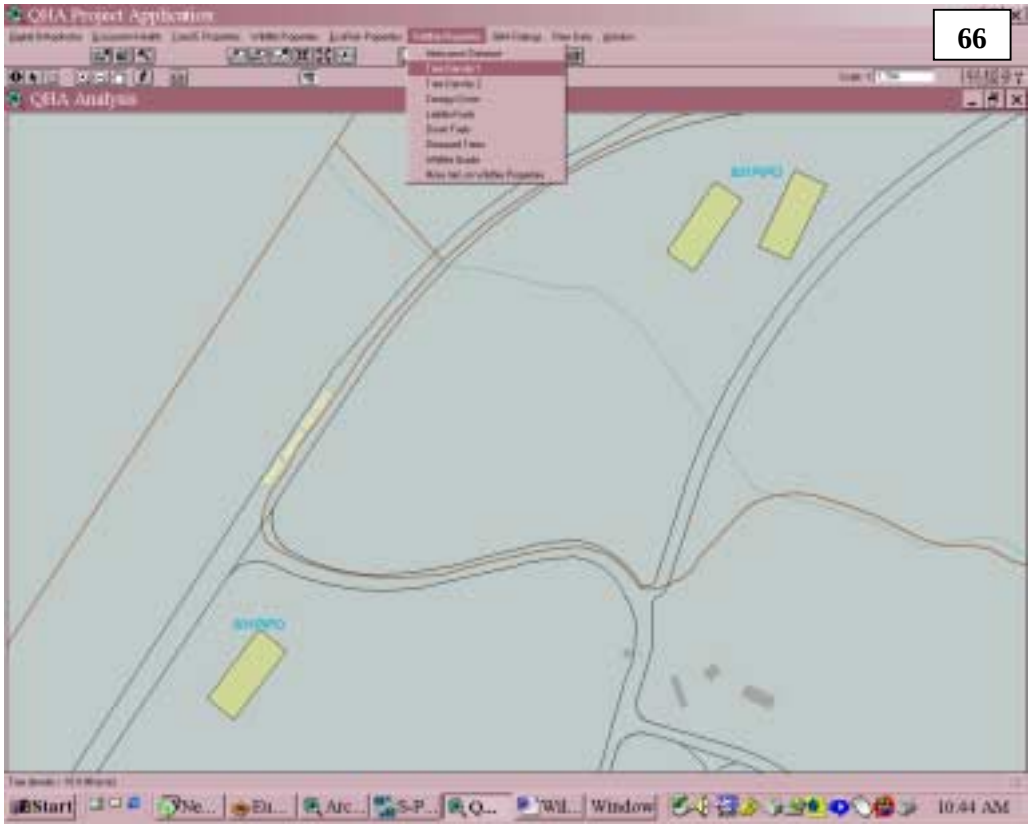
'More Information on Ecological Risk' opens a Word document describing the EcoRisk Property. Close word when viewing is complete.


EcoRisk - Microsoft Word
64
Ecological Risk
Start
10:39 AM

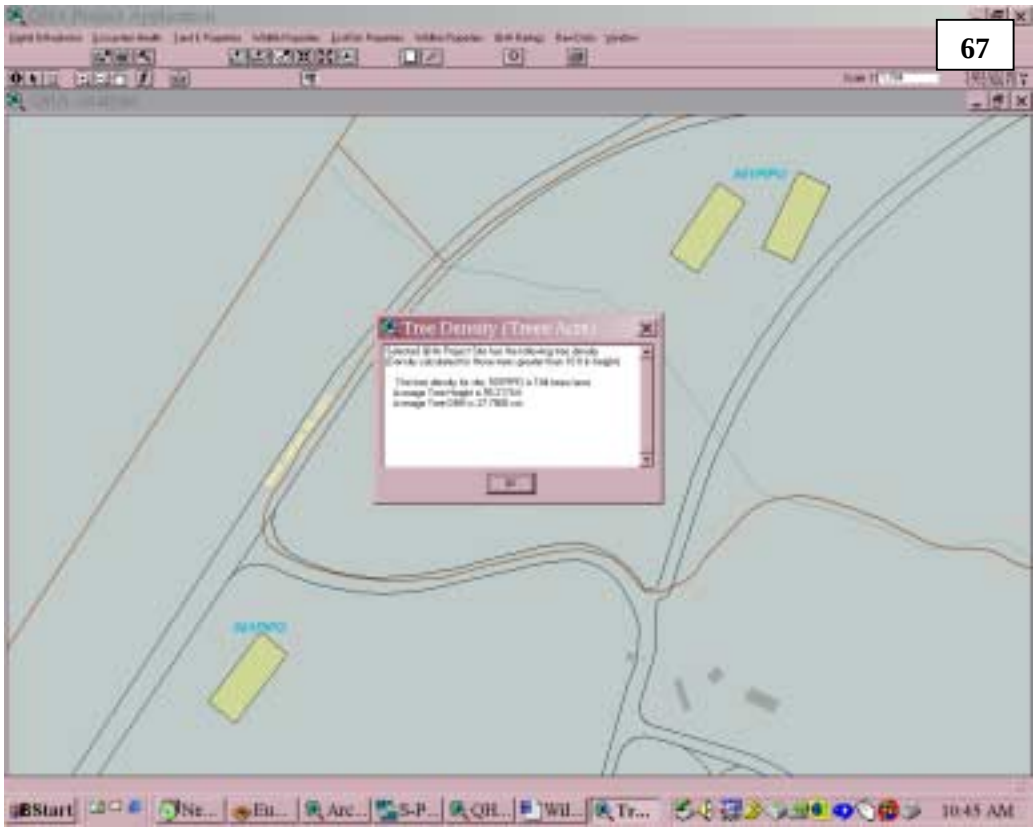
Figures 65–73. Wildfire Properties windows are similar to the others, but data for tree density and various fuels can be listed. Here, tree density is demonstrated as trees per acre, the wildfire grade, and how to get more information on wildfire data.



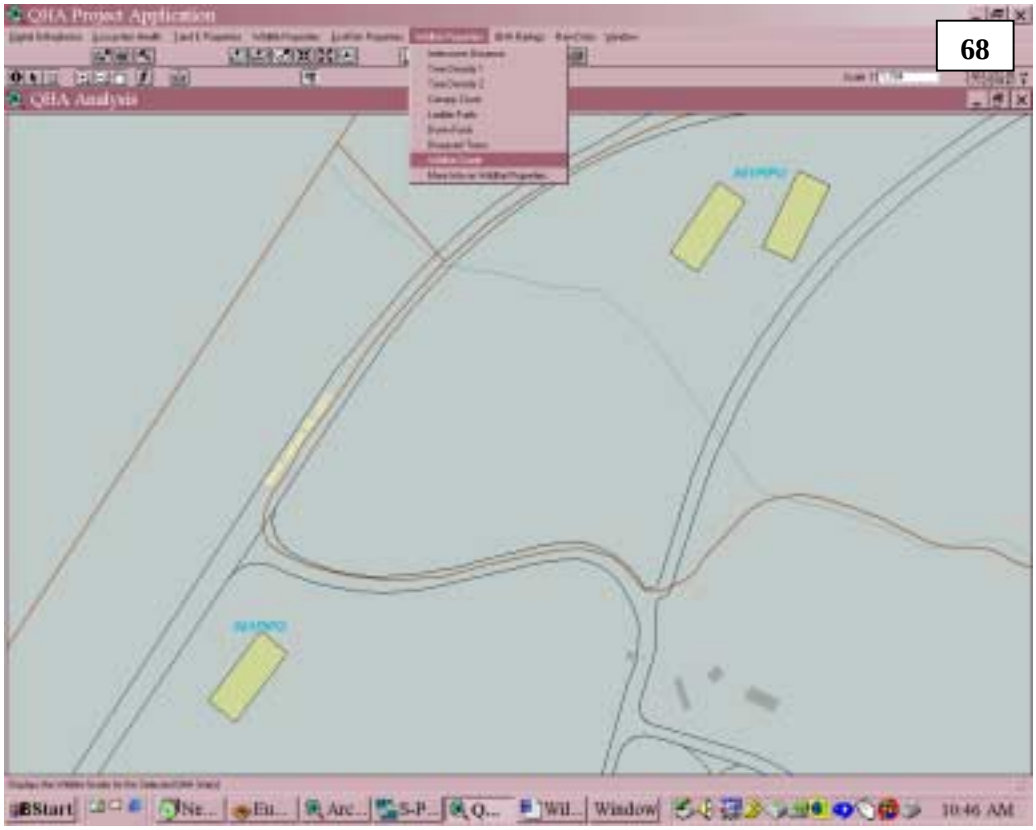
Seven variables are used to determine the wildfire grade.



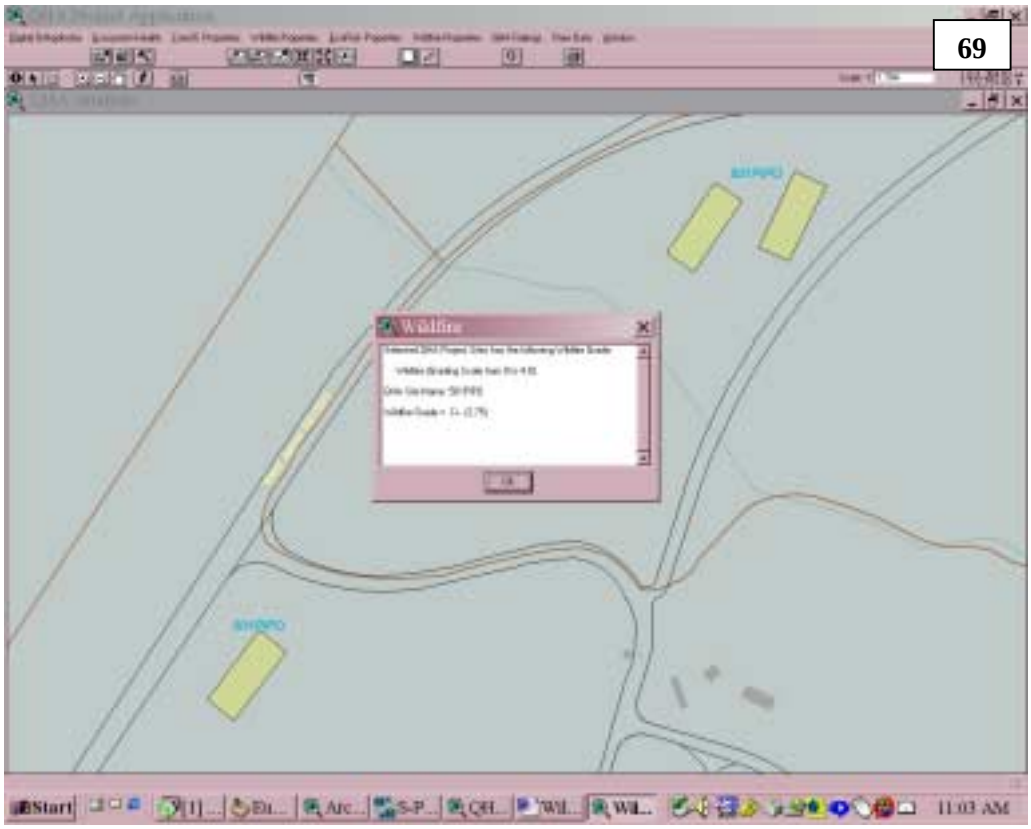
Tree Density 1 is used as an example (density of trees greater than 10 feet tall [trees/acre]).



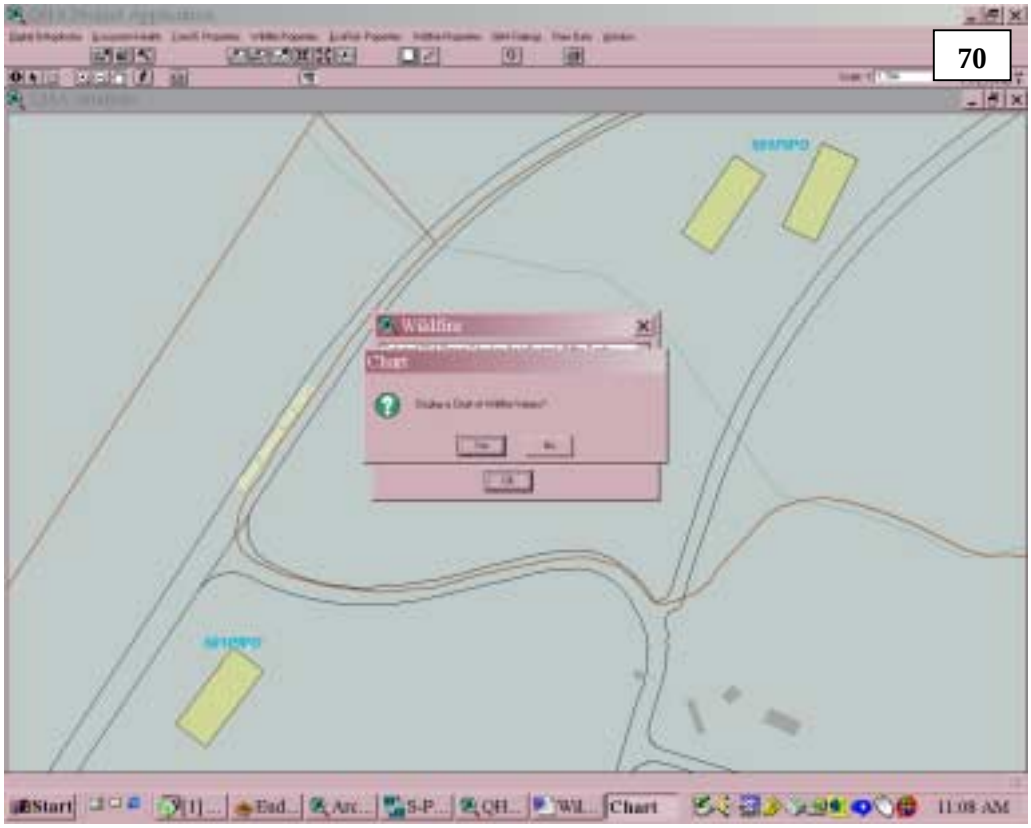
This selection brings up a pop-up window with Average Tree Height, DBH (diameter at breast height) and Density. Click OK when viewing is complete.



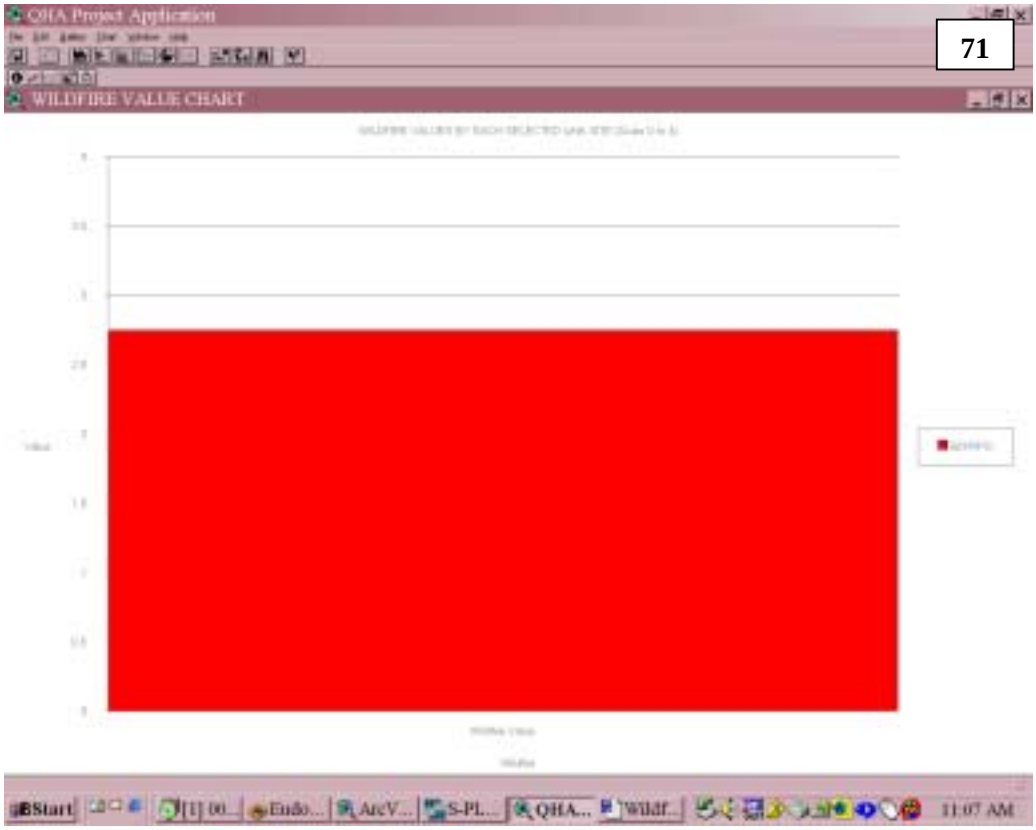
Wildfire Grade



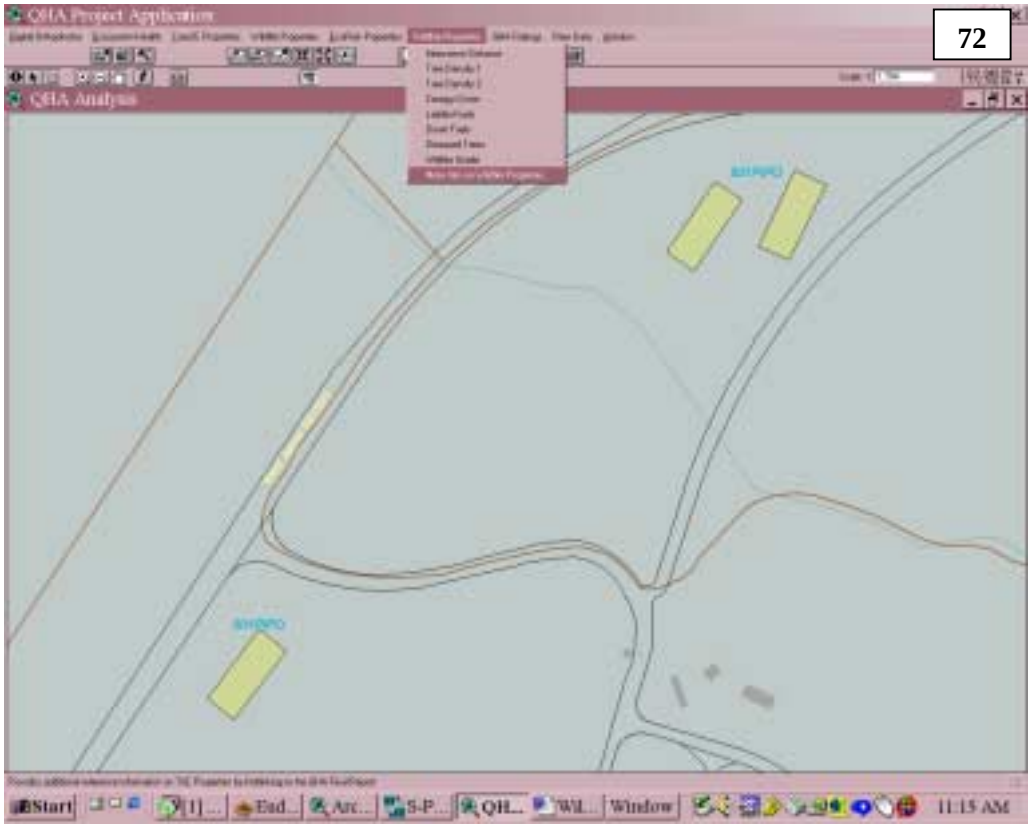
Pop-up window with the Wildfire Grade. Click OK when viewing is complete.



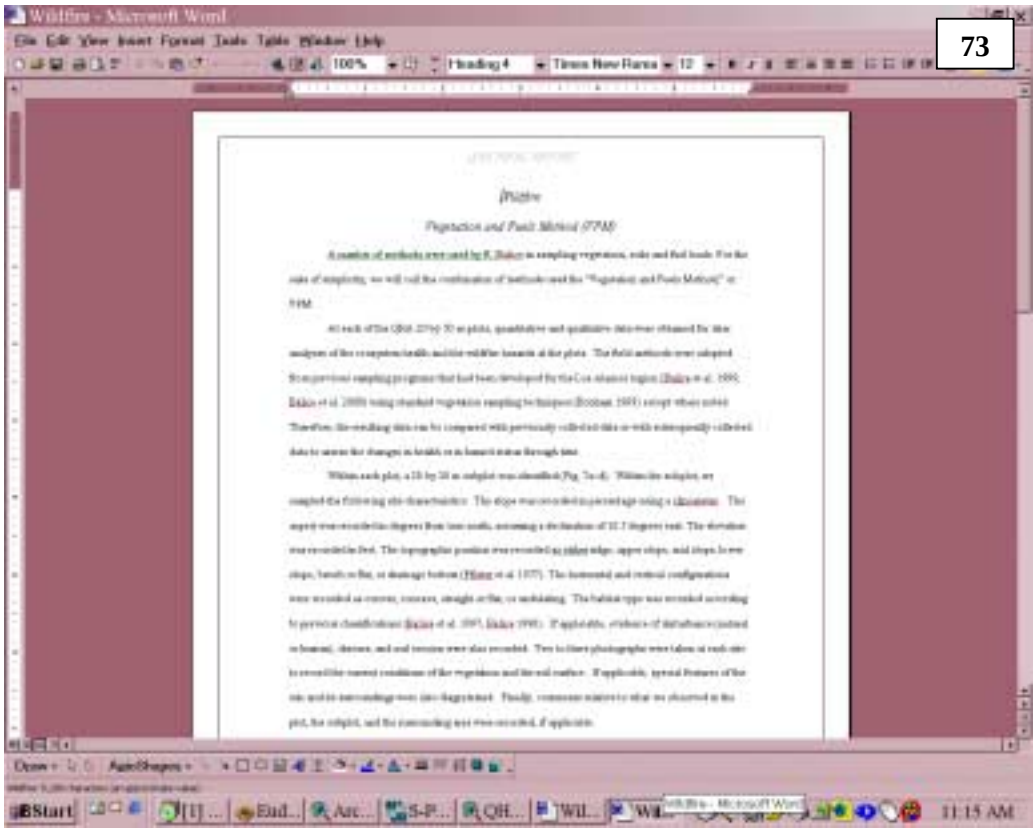
Click Yes to display a chart of the Wildfire Grade.



This selection displays a Chart of Values. Close chart when viewing is complete.

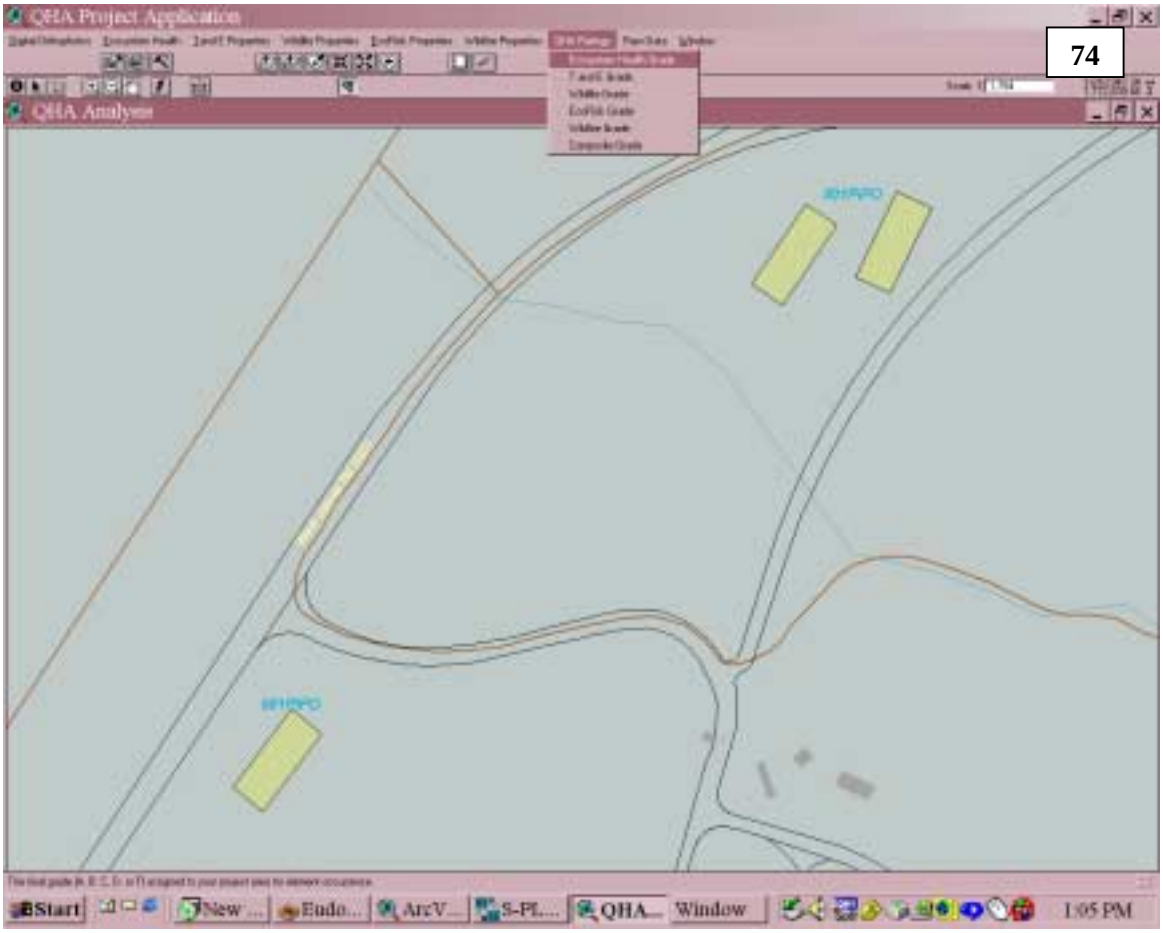


'More Information on Wildfire' brings up a Word Document with Wildfire Information. Close Word when viewing is complete.

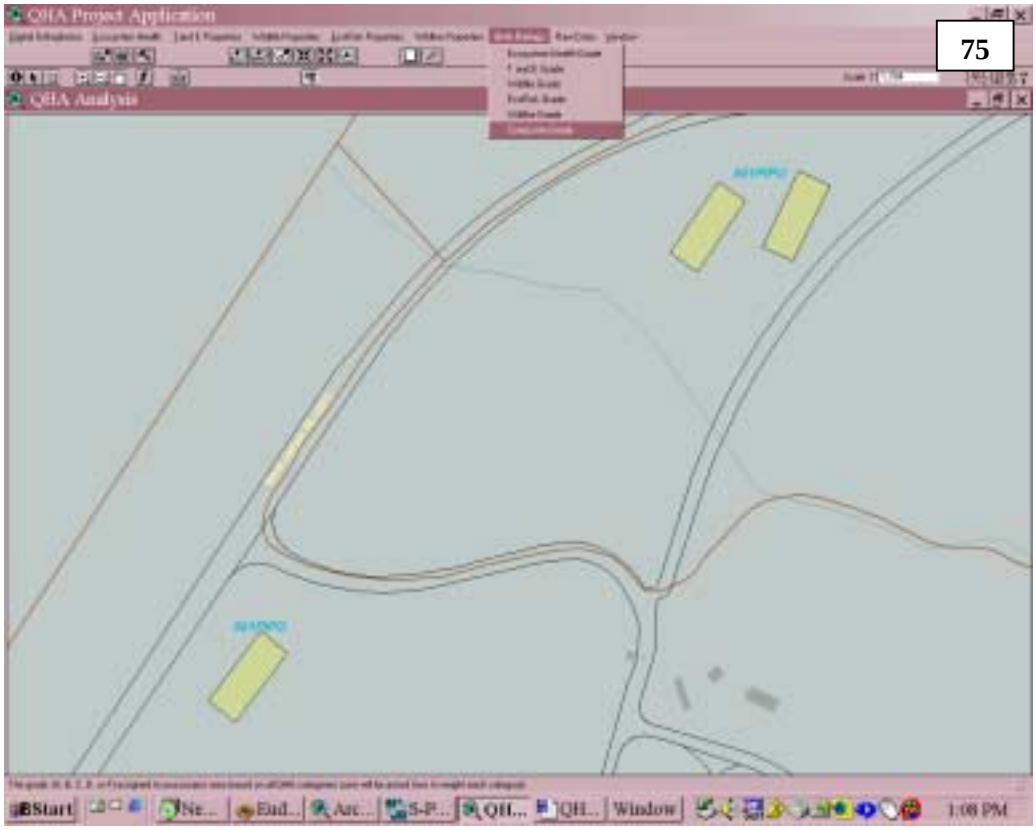


Brings up a Word Document with Wildfire Information—Close Word when viewing is complete.

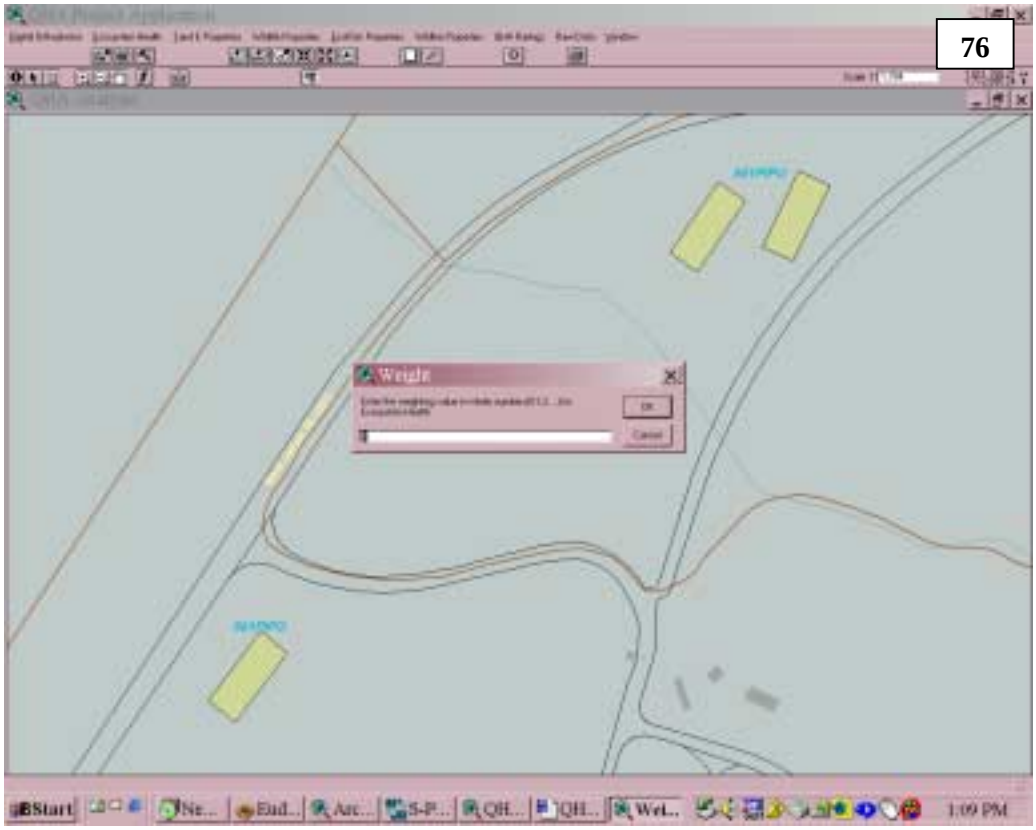
Figures 74–81. QHA ratings are the individual and cumulative scores for each of the categories described previously. If there was no interest in greater detail on each topic, going to this menu item provides a quick look at the common currency scores in one place. For the cumulative score, the user weighs the values depending on the question being asked of the data. The composite grade will be reflected by the weights given and the calculation of the mean value for the categories combined for the site.



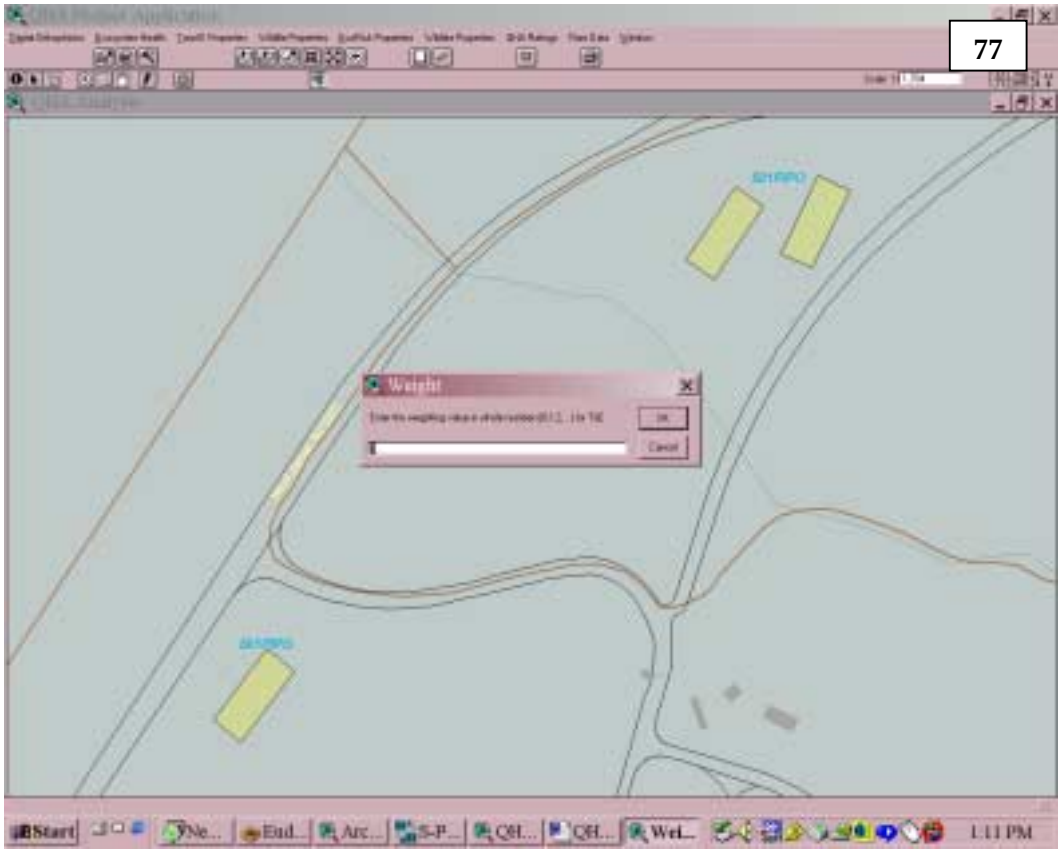
Through this menu you can assess directly the grade for each QHA property instead of going through each individual property menu.



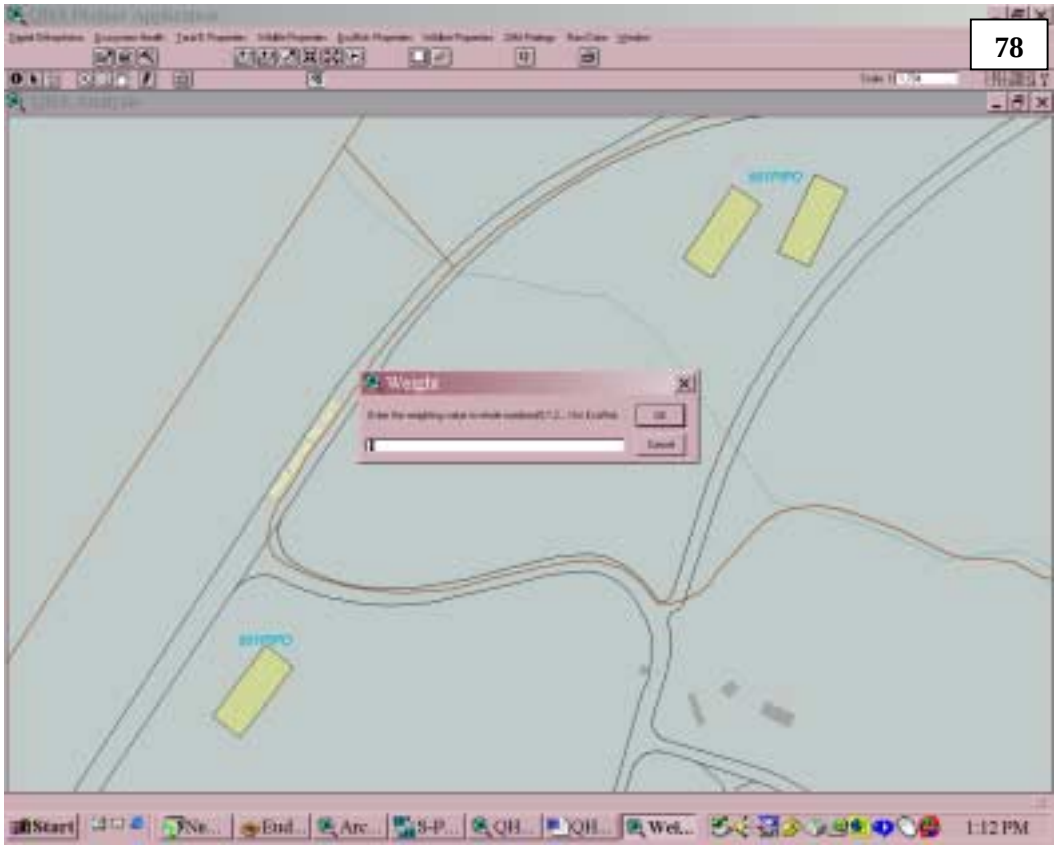
Composite QHA Grade for the Site.



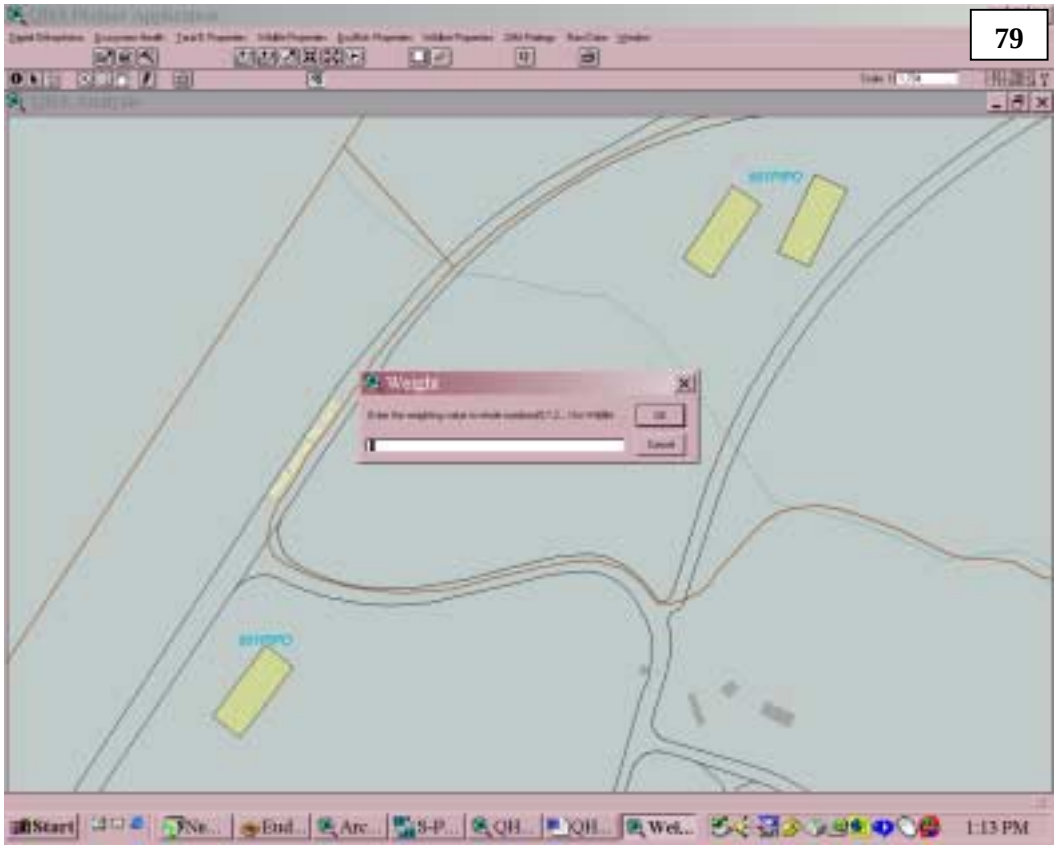
The User weights each property to develop the final QHA Grade. Enter weight for Ecosystem Health (Number must be a whole number).



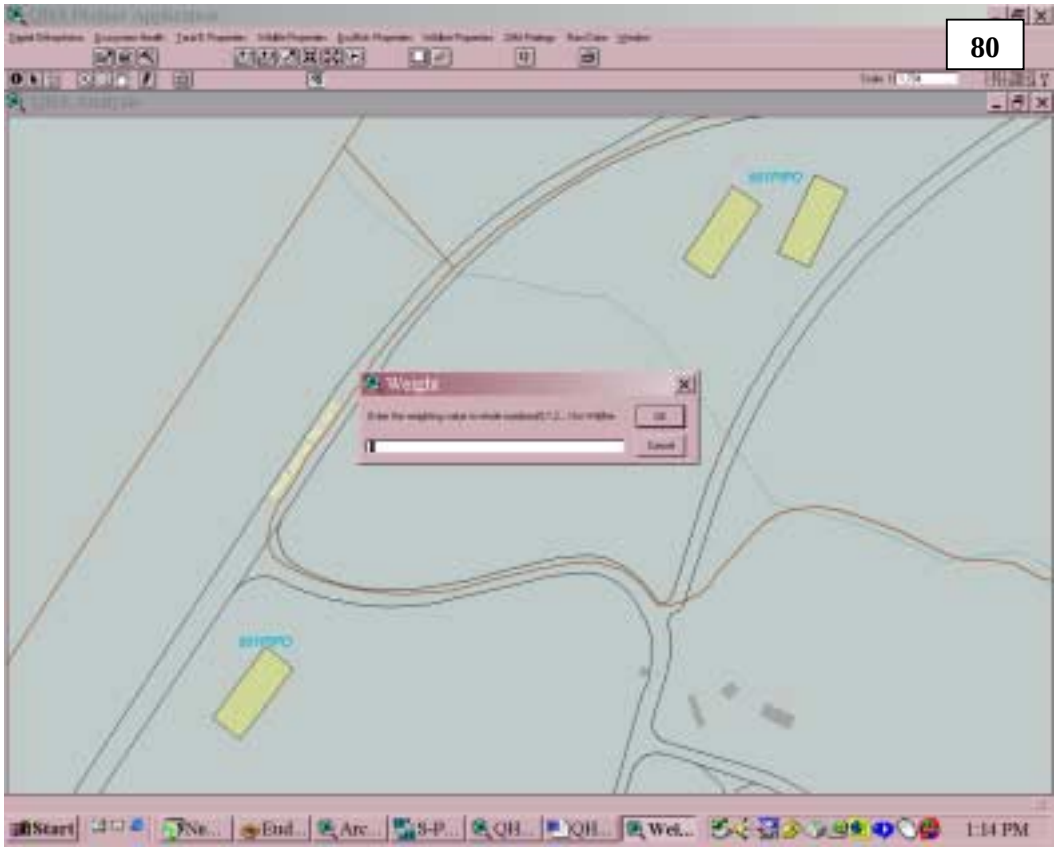
Enter weight for Endangered Species (Number must be a whole number).



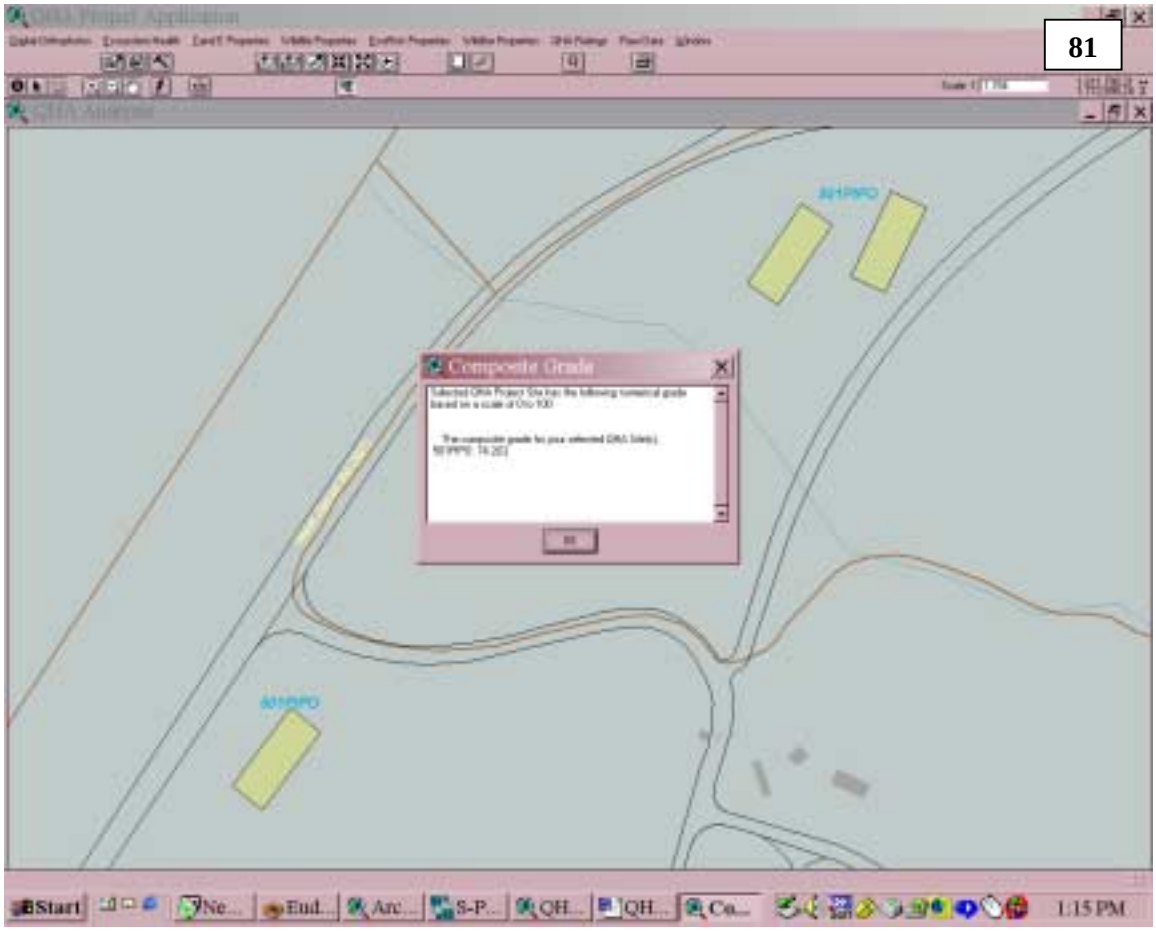
Enter weight for EcoRisk (Number must be a whole number).



Enter weight for Wildlife (Number must be a whole number).

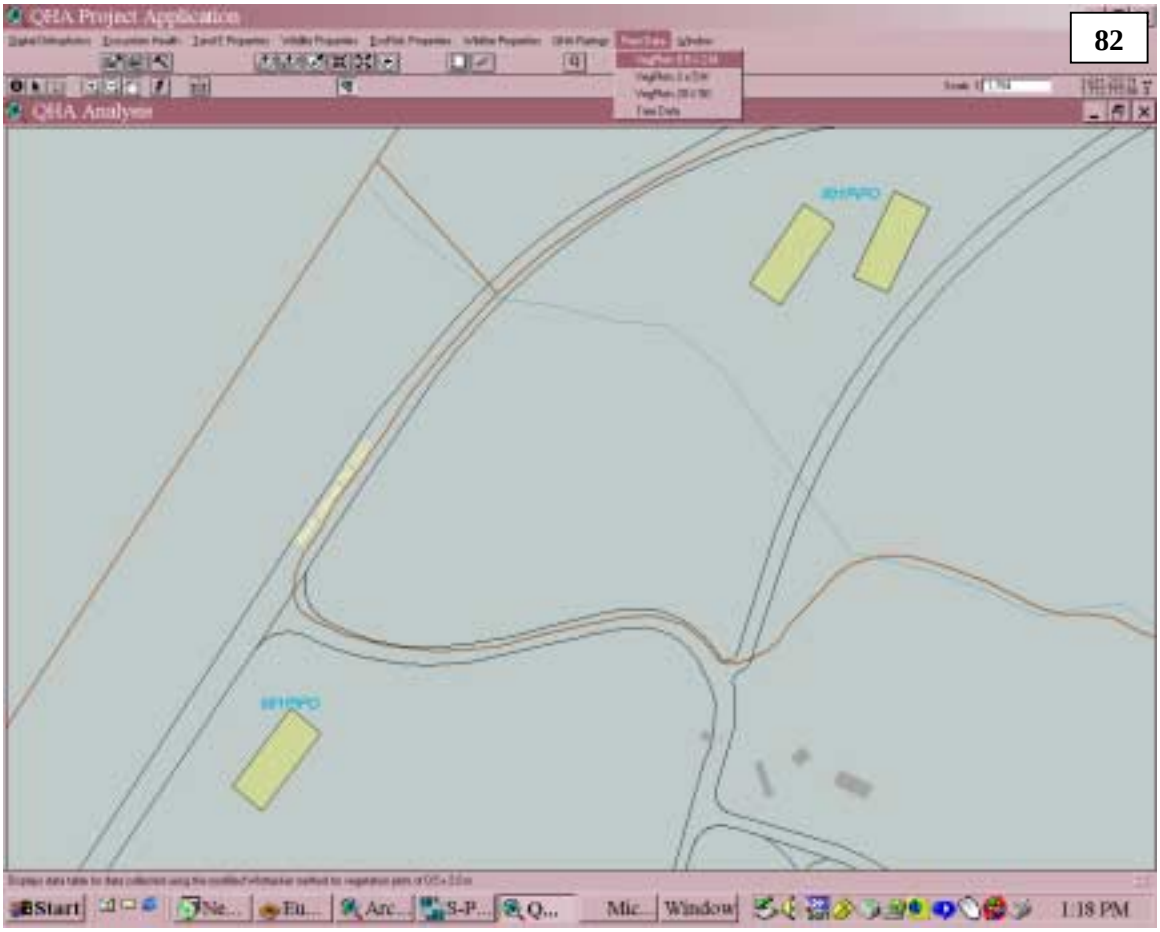


Enter weight for Wildfire (Number must be a whole number).

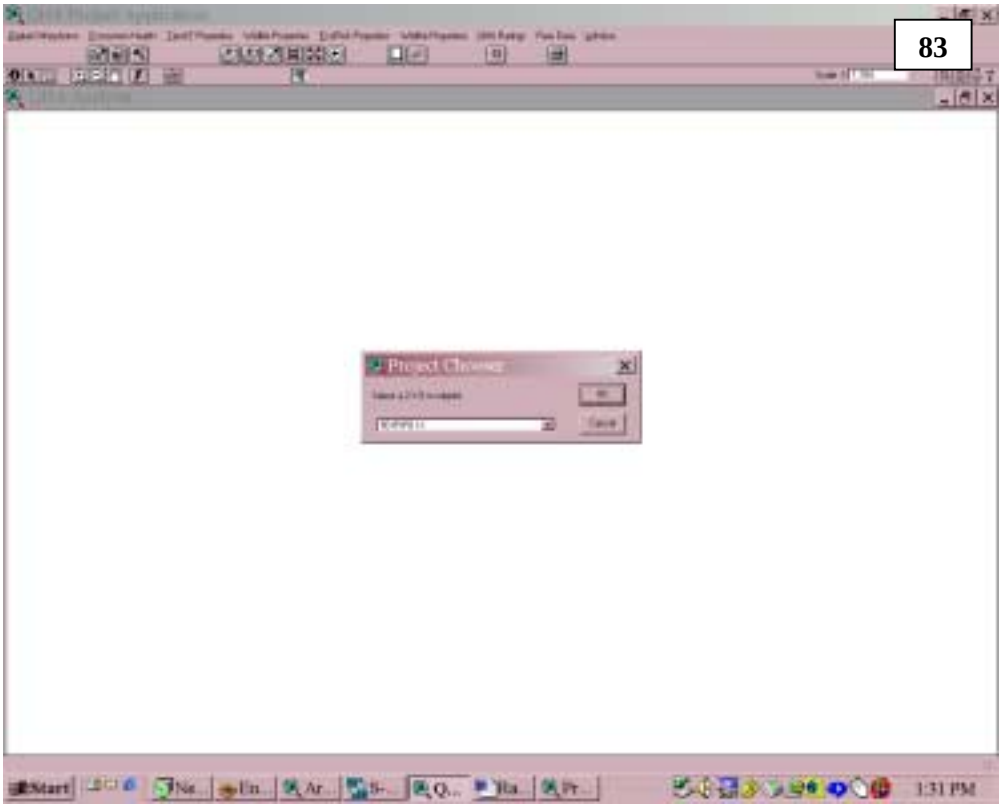


A pop-up window appears with the composite QHA grade based on the weights entered for each property. Click OK when viewing is complete.

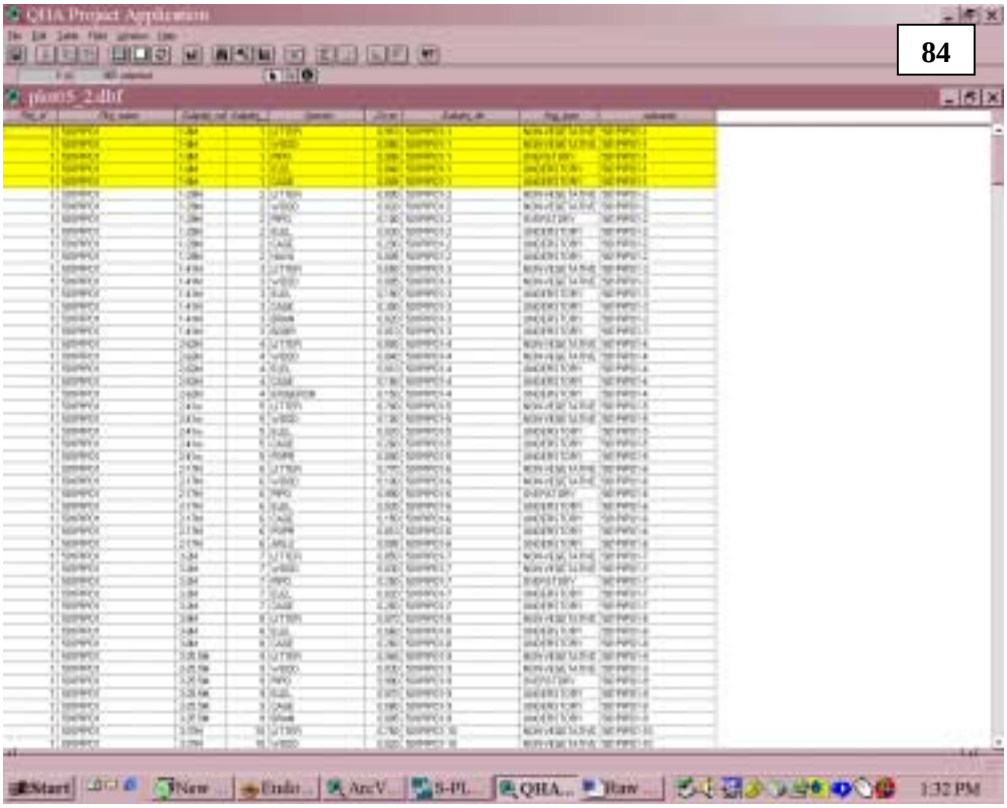
Figures 82–89. Raw Data can be obtained currently for vegetation and trees for a given subplot. These data can be for an individual plot within the site or a combination of all data for the whole site.



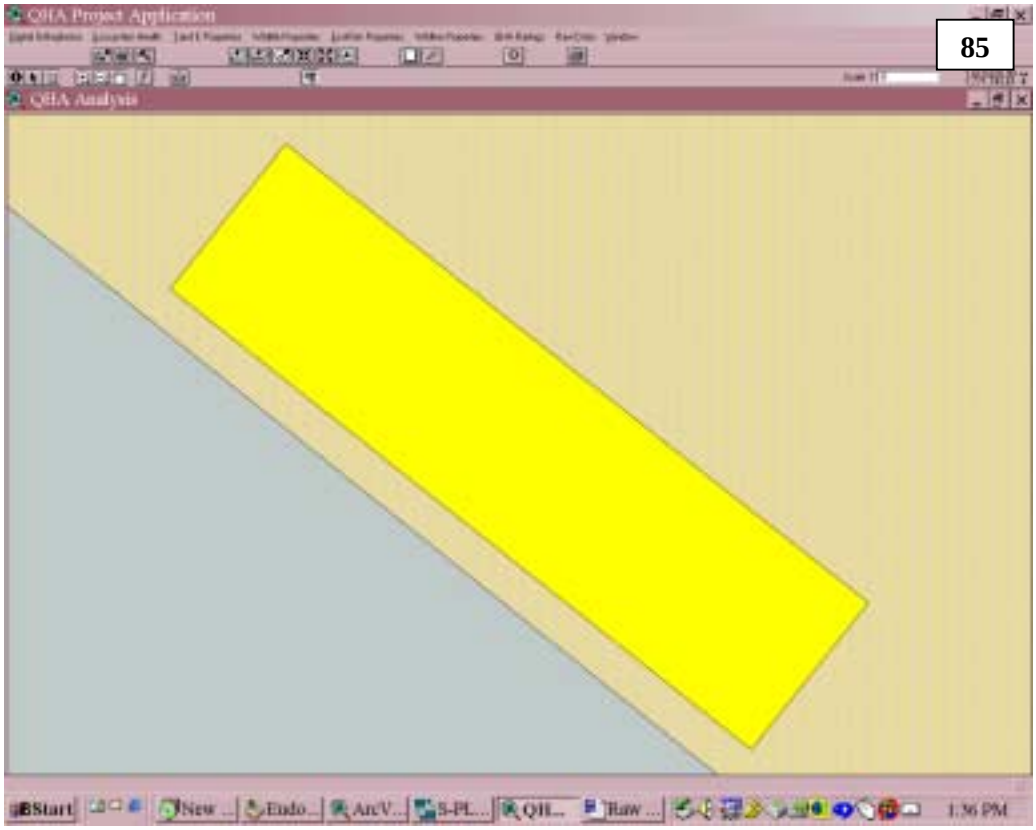
Access raw data through this menu. Currently there is information on three types of vegetation plots as well as tree data.



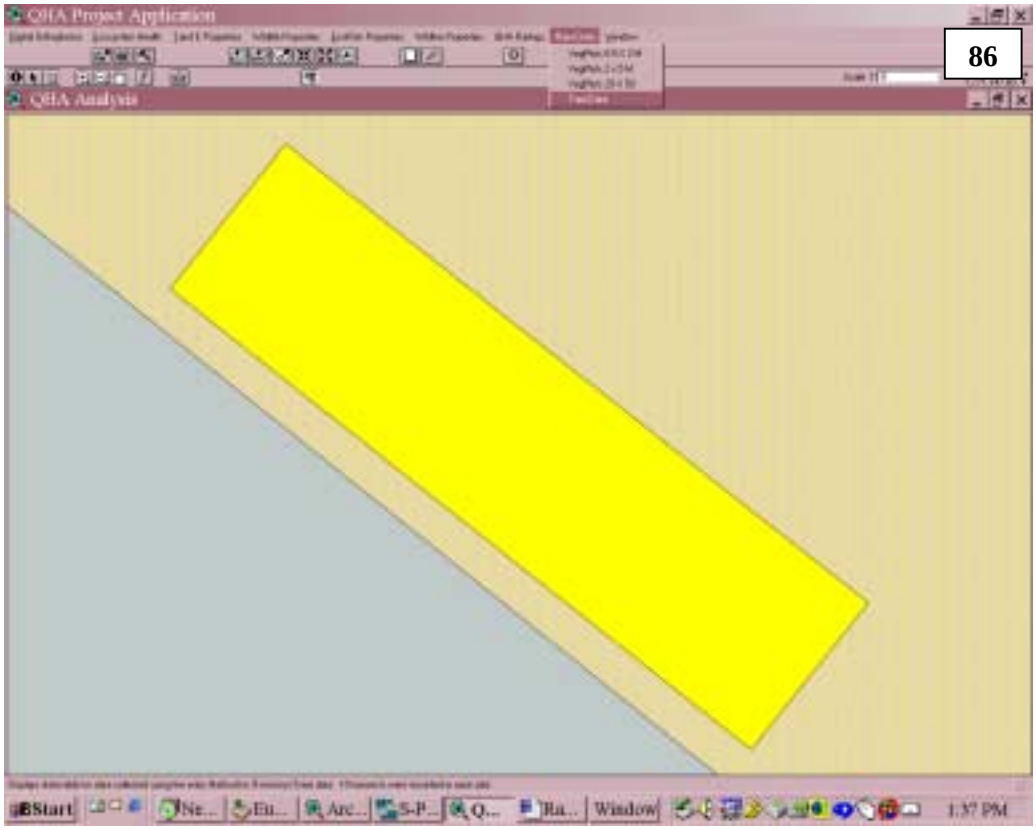
'0.5 × 2 meter plots' brings up a selection box for the user to select which QHA 0.5 × 2 m plot they want to view raw data on. Make selection and click OK.



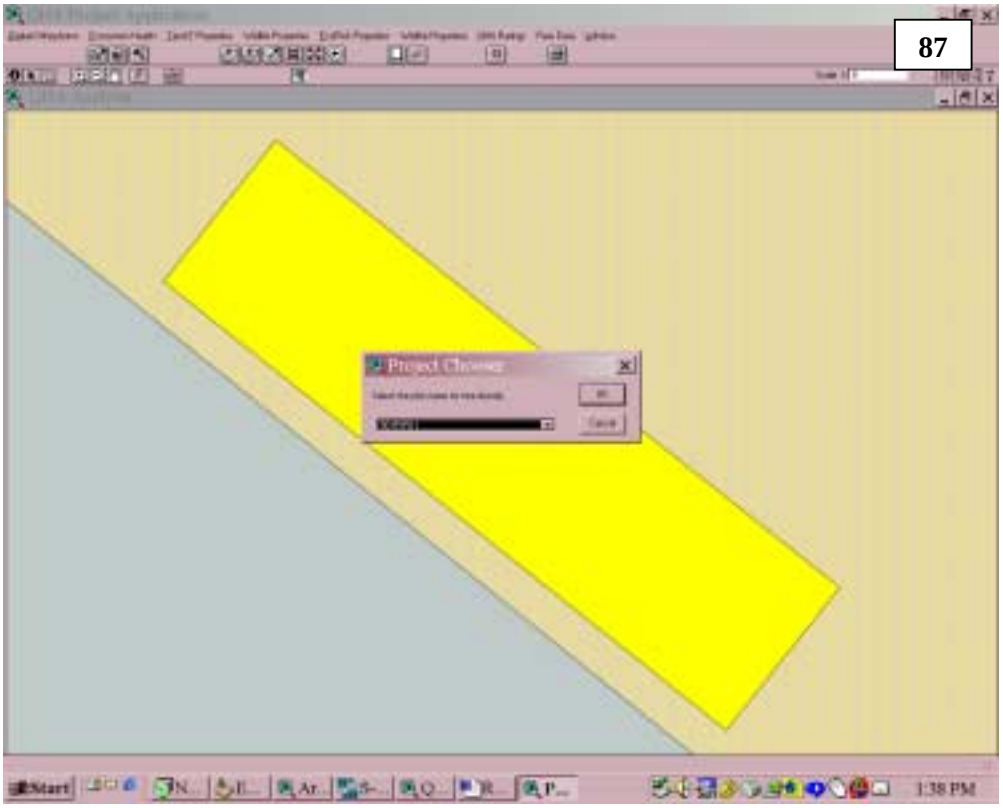
The raw data are brought up in an ArcView table. Yellow highlighted records are from the selected plot. Close the table when viewing is complete. To view other plots, repeat this process.



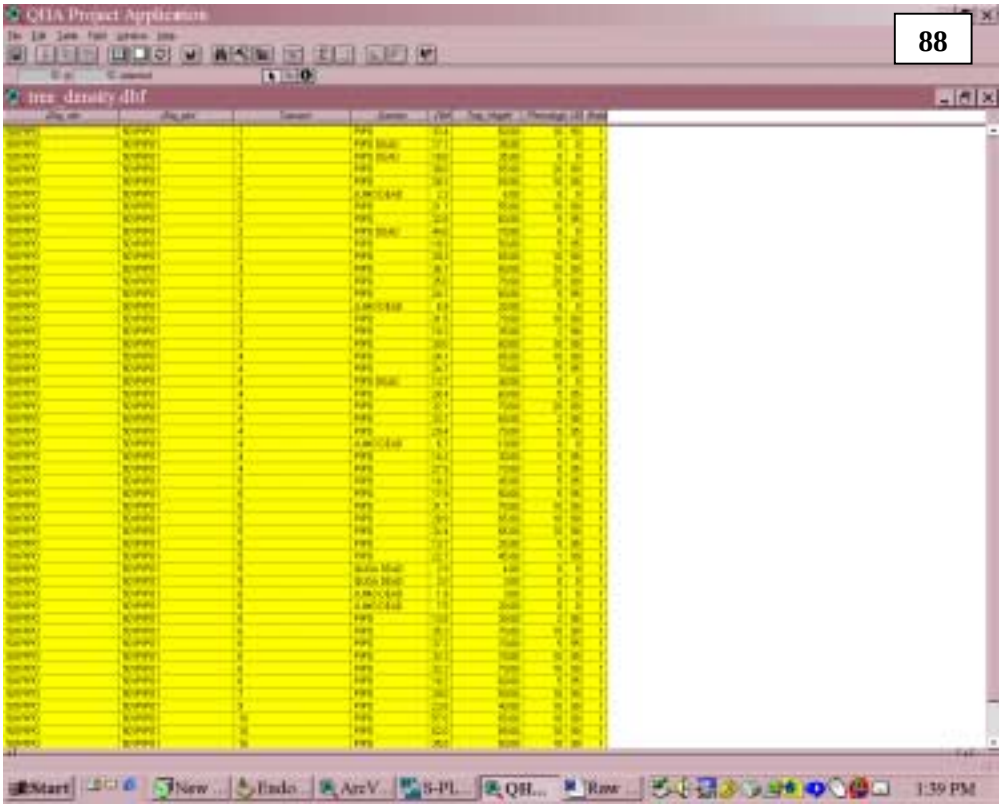
Once the table is closed the View zooms to the location of the plot you selected. To view other plots, repeat this process.



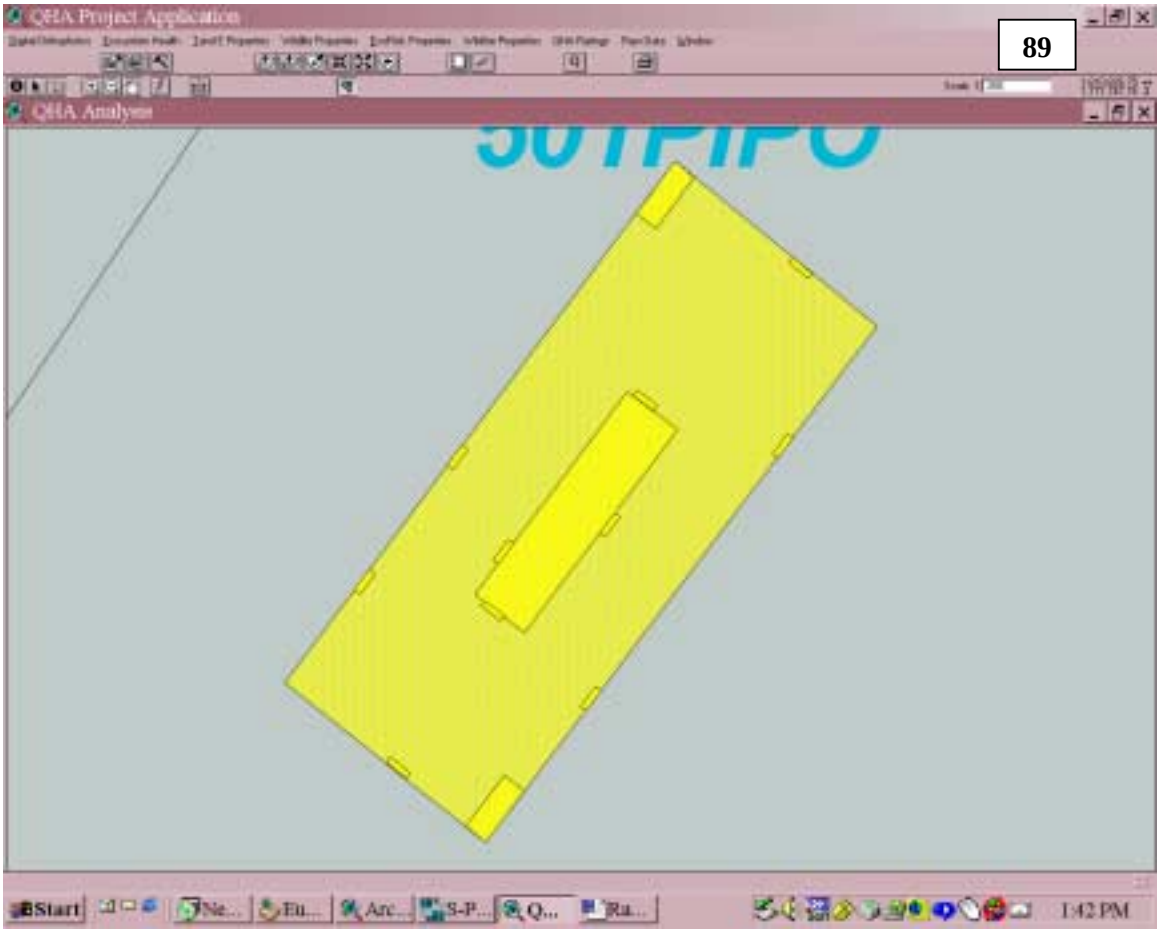
Viewing Tree Data works similar to viewing vegetation plots.



Viewing Tree Data works similar to viewing vegetation plots. The user is prompted to select the plot they would like to view the raw data for.



The raw data are brought up in an ArcView table. Yellow highlighted records are from the selected plot.



Close the table and ArcView zooms to the selected plot.

FUTURE DIRECTIONS

QHA is a tool and model in progress. In FY02, we anticipate collecting more data and testing the model at all levels with the new data. We further plan to add components, such as other computer models and statistical packages, as well as the capability of interpreting other data besides QHA data within the system. That way, this tool will begin to have a broader base and use across the Lab.

REFERENCES

Jackson LJ, Trebitz AS, Cottingham KL. 2000. An Introduction to the Practice of Ecological Modeling. *BioScience* 50(8): 694–706.